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TABLETS

OF

ANATOMY AND PHYSIOLOGY

BY

THOMAS COOKE, F.R.C.S.,

SENIOR ASSISTANT SURGEON TO THE WESTMINSTER HOSPITAL,
AND LECTURER AT THE SCHOOL OF ANATOMY, PHYSIOLOGY, AND OPERATIVE SURGERY,

Being a Synopsis of Demonstrations given in the Westminster Hospital Medical School in the years
1871, -72, -73, -74, & -75.

WITH AN APPENDIX

CONTAINING MOST OF THE NEW DISCOVERIES OF IMPORTANCE MADE KNOWN UP TO THE DATE OF PUBLICATION.

ANATOMY COMPLETE.

SECOND EDITION.

> "The schemes of any of the arts or sciences may be analysed in a sort of skeleton, and represented upon tables, with the various dependencies and connections of the several parts and subjects that belong to them; and the frequent review of these abstracts and epitomes would tend much to imprint them on the brain, when they have been once well learned; this would keep those learned traces always open, and assist the weakness of a labouring memory."
>
> ISAAC WATTS, D.D.,
> ON "THE IMPROVEMENT OF THE MIND."

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PREFACE TO THE FIRST EDITION.

(Anatomy only.)

In a Learner's point of view Scientific facts may, the Author thinks, be divided into those which are daily met with by the Student, and which soon become familiar to him, and those which are learned with considerable pains and afterwards easily forgotten, and which require to be constantly recalled to the mind.

The Author has endeavoured to deal with the latter class of facts only. What every one knows, who has at all studied Medicine, he has purposely left out. Greater condensation is thus obtained. – To the non-medical reader the Tablets may appear disconnected, and the descriptions they contain (if descriptions they may be called) may seem dry and naked. The Author believes that the Student will easily supply the links, and give life and shape to the skeleton sketches.

This book is intended neither for the idle, nor for absolute beginners. The idle will find that it contains more details than they will care to master, and that its brevity demands more mental application than would be agreeable to any one, whose mind has not been trained to close study.

Beginners, however, who mean to work, may, after attending a lecture, or reading up in one of the Standard Authors a region they have just been dissecting, advantageously revise the subject in the Tablets; and these partial revisions will be found to fix the main points in the mind, and to facilitate the more important revisional effort, which, even the first year's student is usually called upon to make, whenever his lecturer has finished describing a part, or he himself has finished dissecting one.

The more or less advanced Students, who are doing, or have done, their work honestly and conscientiously, are the ones the Author has had mainly in view.

16, Woburn Place, Russell Square,

September, 1875.

PREFACE TO THE SECOND EDITION (1878).

(Anatomy and Physiology.)

In the present Edition, only those pages have been recast, which were considerably out of date; the others, when requiring alteration, have simply been supplemented by an *Appendix,* which has been incorporated with the work, as far, at least, as could well be done without involving considerable book-binder's labour. The pages of this Appendix have been marked 8A, 8B, 12A, 12B, 12C, etc., in correspondence with the pages they are intended to supplement or correct; and its headings have been *underlined red,* to call attention to the new matter.

A fresh Appendix *containing new discoveries of importance* will be published every two or three years. And every succeeding Appendix will be issued both separately and incorporated with the work.

The present Appendix to the Anatomy refers to the Viscera, & to the Organs of the Senses. It has been inserted after pages 290, & 360. Dr. Gowers' new description of the Gray Matter of the Cerebellum, and the views of Lockhart Clarke, Stilling, and others on the cranial nerves, etc., will also be found on pages 213, 230, & 250, of the text. Descriptions of the Thymus & Thyroid Bodies and Suprarenal Capsules have been added; also a careful description of the Teeth.

In the Physiology, new matter is more abundant: The Appendix numbers forty pages. Twelve supplement Circulation; four, Respiration; eight, Digestion; four, the General Development of the Embryo; eight, the Development of the Organs; and four are included under the heading "Addenda." – The two aspects of Physiology, the old & the new, are thus, to a certain extent, placed side by side. The latter parts of the work,—Nervous System, the Senses, and the greater part of Embryology,—having been re-written very recently, are not, for the present, supplemented.

The Embryology will be found fairly complete & up to date. Both the older & the more modern views have been presented with respect to the Pharynx, Œsophagus, & Respiratory Tract, and with respect to the questions arising out of the disputed homologies of the Genital Ducts. A few divisions have been introduced into the study of some of the subjects.

The History of the development of the Bones & Teeth concludes the volume; – the former subject being divided into two parts, *Skeletal Matrix,* and *Ossification of the Individual Bones.*

The diagrams representing the development of the veins are after those of Dr. Dalton of New York, who has treated the subject most skilfully & completely.* They have been engraved by Mr. W. Gibbs of Fleet Street.

Histology & chemical physiology will be treated in a separate volume.

ANATOMY & PHYSIOLOGY *COMPLETE* – By this phrase it is simply meant that all the subjects have been treated, which appeared susceptible of being treated *advantageously* in the Tabular form :– "*In a Learner's point of view, Scientific facts may be divided into those which are daily met with by the Student, and which soon become familiar to him, and those which are learned with considerable pains & afterwards easily forgotten, and which require to be constantly recalled to the mind. The Author has endeavoured to deal with the* LATTER CLASS OF FACTS ONLY." (V. Preface to the First Edition).

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* J. C. DALTON – Treatise of Human Physiology, Philadelphia, 1871, & 76.

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ADVICE TO STUDENTS.

The principal rules of the art of learning are to classify, to condense, and to proportion, according to their relative importance, the attention to be given to the facts that are to be retained.

Classify.—Group things that are alike; thus, in learning one, several will be acquired.

Condense.—The more concise the wording is, the more facts can be gone over in a given time, and the better they can be remembered. A firm grasp of the facts is what is wanted first; erudition may be courted afterwards.

Proportion according to their relative importance the attention to be given to the facts that are to be retained. The headings & subheads should be mastered first; then, in succession, the divisions, the sub-divisions, the principal points, the minor points, the noteworthy details, the minutiæ.

The Tablets are intended to assist the Student in carrying out these rules:

The *grouping* and the *condensing* are done for him to a considerable extent.

The arrangement adopted will further induce him, it is hoped, to proportion his attention rightly: – The Tablets, especially those on Anatomy, show at a glance the general outline of the subject they treat of; this outline should be studied first, and thoroughly understood and mastered before the Student goes any further. *This is of primary importance for the successful use of the Tablets,* which, the Author would remind the Student, are intended simply to assist him in reading the standard Authors with greater profit and ease, *not to take the place of any other work.*

THE BONES.

THE VERTEBRÆ

Present for examination: –

Body – Forms a short column, which presents:

Ant. Surface – Convex from side to side, concave from above downwards; presents numerous small vascular foramina.

Post. Surface – Concave from side to side, flat from above downwards; presents one or more irregular apertures for exit of venæ basis vertebræ.

Upper & Under Surfaces – Rough & slightly concave, and surrounded by a prominent rim.

Pedicles – Join the body to the laminæ. They are constricted, and their constriction gives rise to the

Notches – Which latter, by the superposition of the vertebræ, form the *intervertebral foramina.*

Laminæ – Broad & flat, rough above & below for the ligamenta subflava; bound posteriorly the

Foramen – Which, by the superposition of the vertebræ, forms the spinal canal.

Spinous process – Projects backwards from the point of junction of the laminæ.

Transverse processes – Two. Project outwards from the sides of the arch.

Articular processes – Four. Project upwards & downwards from the point of junction of the pedicles with the laminæ. The superior ones look backwards, the inferior ones look forwards.

N. — But little, which would be applicable to *each* of the three groups of vertebræ, can, it is believed, be added to this description.

THE THREE GROUPS of VERTEBRÆ.

CERVICAL VERTEBRÆ — The smallest. Present: -

BODY — Small, broad from side to side. Presents: -

UPPER SURFACE - Concave from side to side, and rounded off anteriorly.
UNDER SURFACE - Convex from side to side, and prolonged downwards anteriorly.
ANTERIOR SURFACE - Situated therefore on a lower level than the posterior.

PEDICLES — Arise from lower part of body, and of the two
NOTCHES — The superior ones are the deepest, and somewhat the narrowest.
LAMINÆ — Long and narrow.
FORAMEN — Large and triangular.
SPINOUS PROCESS — Projects horizontally backwards, and is short, bifid, & grooved inferiorly.
TRANSVERSE PROCESSES — Short, bifid, grooved superiorly, perforated at their base for passage of vertebral artery & vein, and situated *on the outer side of the pedicles, in front of the articular processes.*

The existence of the foramen at the base of the cervical transverse processes, and the situation of these processes on the outer side of the pedicles, are owing to their being formed of two roots, which roots correspond, the posterior one to the transverse processes properly so-called, the anterior one to the ribs.

ARTICULAR PROCESSES — Form a small vertical column. The superior ones look upwards & backwards, the inferior ones look downwards & forwards.

DORSAL VERTEBRÆ — Intermediate in size. Present: -

BODY — Heart-shaped, thicker behind than in front, and has two demi-facets on each side, which demi-facets articulate with the heads of the ribs.
PEDICLES — Arise from upper part of body, and of the two
NOTCHES — The inferior ones are the deepest and broadest.
LAMINÆ — Short & broad.
FORAMEN — Small & round.
SPINOUS PROCESS — Long, triangular, oblique, and ends in a single tubercle.
TRANSVERSE PROCESSES — Long, thick, obliquely directed outwards & backwards, and situated *behind the articular processes & the pedicles.* Their extremity is enlarged, and presents in front an articular facet for tubercle of corresponding rib.

From the back of the extremity of the few lower dorsal transverse processes arise three tubercles, termed *external, inferior, & superior,* which tubercles correspond respectively to the transverse processes of the lumbar vertebræ, and to the accessory & mammillary tubercles found, the former on the back of the transverse processes, the latter on the back of the superior articular processes of the lumbar vertebræ.

ARTICULAR PROCESSES — Nearly vertical. The superior ones look backwards & outwards, the inferior ones look forwards & inwards.

LUMBAR VERTEBRÆ — The largest. Present: -

BODY — Large, broadest from side to side, rather thicker in front than behind.
PEDICLES — Thick; arise from upper part of body, and of the two
NOTCHES — The inferior ones are the deepest & broadest.
LAMINÆ — Short, broad & thick.
FORAMEN — Triangular, larger than in the dorsal region, smaller than in the cervical.
SPINOUS PROCESS — Thick, quadrilateral, and ends in a rough vertical border.
TRANSVERSE PROCESSES — Long, slender, directed transversely outwards, and situated *in front of the articular processes, but behind the pedicles,* and in a line with the external tubercles of the lower dorsal transverse processes, to which they correspond.

On the back of each, near its base, is a small tubercle the *accessory tubercle,* which points downwards & inwards, and which corresponds to the inferior tubercles on the lower dorsal transverse processes.

ARTICULAR PROCESSES — Thick, strong & vertical. The superior ones are concave, look backwards & inwards, and are farther apart than the inferior ones, which they embrace. The inferior ones are convex, look forwards & outwards, and are nearer to each other than are the superior ones.

On the back of each superior articular process is a small tubercle, the *mammillary tubercle,* which corresponds to the superior tubercles on the lower dorsal transverse processes.

THE THREE GROUPS COMPARED SERIATIM.

Body – Cervical – Small, broad from side to side. Presents: –
Upper Surface – Concave from side to side, & rounded off anteriorly.
Under Surface – Convex from side to side, & prolonged downwards anteriorly.
Anterior Surface – Situated therefore on a lower level than the posterior.
Dorsal – Heart-shaped, thicker behind than in front, and has two demi-facets on each side which demi-facets articulate with the heads of the ribs.
Lumbar – Large, broadest from side to side, rather thicker in front than behind.

Pedicles – Cervical – Arise from lower part of body.
Dorsal – Arise from upper part of body.
Lumbar – Thick; arise from upper part of body.

Notches – Cervical – The superior ones are the deepest, and somewhat the narrowest.
Dorsal – The inferior ones are the deepest and broadest.
Lumbar – The inferior ones are the deepest & broadest.

Laminæ – Cervical – Long & narrow.
Dorsal – Short & broad.
Lumbar – Short, broad & thick.

Foramen Cervical – Large & triangular.
Dorsal – Small & round.
Lumbar – Triangular, larger than in the dorsal, smaller than in the cervical.

Spinous Process —
Cervical – Projects horizontally backwards, and is short, bifid, & grooved inferiorly.
Dorsal – Long, triangular, oblique, and ends in a single tubercle.
Lumbar – Thick, quadrilateral, and ends in a rough vertical border.

Transverse Processes —
Cervical – Short, bifid, grooved superiorly, perforated at their base for passage of vertebral artery & vein, and situated *on the outer side of the pedicles, in front of the articular processes.*
Dorsal – Long, thick, obliquely directed outwards & backwards, and situated *behind the articular processes & the pedicles.* Their extremity is enlarged, and presents in front an articular facet for tubercle of corresponding rib.
From the back of the extremity of the few lower dorsal transverse processes arise three tubercles, termed *external, inferior,* & *superior,* which tubercles correspond respectively to the transverse processes of the lumbar vertebræ, and to the accessory & mammillary tubercles found, the former on the back of the transverse processes, the latter on the back of the superior articular processes of the lumbar vertebræ.
Lumbar – Long, slender, directed transversely outwards, and situated *in front of the articular processes, but behind the pedicles,* and in a line with the external tubercles of the lower dorsal transverse processes, to which they correspond.
On the back of each, near its base, is a small tubercle the *accessory tubercle,* which points downwards & inwards, and which corresponds to the inferior tubercles on the lower dorsal transverse processes.

Articular Processes —
Cervical – Form a small vertical column. The superior ones look upwards & backwards, the inferior ones look downwards & forwards.
Dorsal – Nearly vertical. The superior ones look backwards & outwards, the inferior ones look forwards & inwards.
Lumbar – Thick, strong & vertical. The superior ones are concave, look backwards & inwards, and are farther apart than the inferior ones, which they embrace. The inferior ones are convex, look forwards & outwards, and are nearer to each other than are the superior ones.
On the back of each superior lumbar articular process is a small tubercle, the *mammillary tubercle,* which corresponds to the superior tubercles on the lower dorsal transverse processes.

PECULIAR VERTEBRÆ

Are the:

Atlas } Vide following Tablet.
Axis }

7th Cervical Vertebra, or Vertebra Prominens

Spinous process thick, long, prominent, nealy horizontal; ends in a single tubercle for ligamentum nuchæ.

Transverse process large, but slightly grooved, seldom bifid. Its foramen is usually small, sometimes wanting, and seldom gives passage to both artery & vein.

1st Dorsal Vertebra

Body broad from side to side and lipped superiorly & behind; presents a complete facet above for head of 1st rib, and a demi-facet below for upper facet on head of 2nd rib.

Spinous process thick & but slightly inclined.

Articular processes somewhat oblique, as in the cervical vertebræ.

9th Dorsal Vertebra

Usually no inferior demi-facet.

10th Dorsal Vertebra

But one costal facet (the superior), which is usually complete.

11th Dorsal Vertebra

But one costal facet, which is always complete.

Transverse processes short, and without articular facets.

12th Dorsal Vertebra

But one costal facet, which is always complete.

Transverse processes short, and without articular facets.

Inferior articular facets, convex and looking forwards & outwards like those of lumbar vertebræ.

5th Lumbar Vertebra

Body much thicker in front than behind.

Spinous process small.

Inferior articular processes, farther apart than superior.

Transverse processes, large, thick, slightly inclined upwards.

ATLAS & AXIS.

THE ATLAS

Presents anterior & posterior arches, foramen, and lateral masses.

ANTERIOR ARCH — Presents:

Anterior Surf. – Convex, in centre of which is a *tubercle* for superior oblique portion of longus colli, and for superficial anterior occipito-atloid & superficial anterior atlo-axoid ligaments.

Posterior Surf. – Concave, in centre of which is an *oval facet*, which articulates with odontoid process of axis.

Upper & Lower Borders – For deep anterior occipito-atloid & deep anterior atlo-axoid ligaments.

POSTERIOR ARCH — Presents just behind the lateral masses the *Grooves* representing the *superior & inferior intervertebral notches.* – The superior grooves, which are the deepest and are sometimes converted into complete foramina, transmit the vertebral artery & the suboccipital nerve.

The posterior arch then becomes rounded, and is rough above & below for the posterior occipito-atloid & posterior atlo-axoid ligaments. It ends posteriorly in a *tubercle* for rectus capitis posticus minor.

FORAMEN — Large, and divided by transverse ligament (transverse portion of crucial ligament) into a posterior part, the largest, for spinal cord & its membranes, and an anterior part, the smallest, which receives the odontoid process of the axis.

LATERAL MASSES — Short & thick columns of bone, which present internally, externally, above & below, a *tubercle* for the transverse ligament;

Transverse Process – Large, not bifid nor grooved superiorly, perforated at its base by a very large foramen;

Sup. Articular Surf. – Large, oval, concave, converging towards its fellow anteriorly, and looking upwards, inwards & slightly backwards.

Inf. Articular Surf. – Rather smaller, flat, circular, and looking downwards & inwards.

THE AXIS

Presents the following peculiarities

Body – A good deal thicker in front than behind. It presents anteriorly a *median ridge & two lateral depressions* for part of internal or vertical portion of longus colli, and is surmounted by the

Odontoid Process – Tooth-like, presenting:

Apex – For median or suspensory occipito-odontoid ligament, and, laterally, for lateral occipito-odontoid, or check ligaments.

Body – Articular in front & behind for anterior arch of atlas & transverse ligament.

Neck – Constricted, and bound down by transverse ligament.

Pedicles – Strong & thick, lie beneath the superior articular surface, and are but very slightly grooved superiorly.

Notches – The superior are very shallow, and lie behind the superior articular surfaces: the inferior ones are much deeper and lie in front of the corresponding articular surfaces.

Laminæ – Thick & strong.

Foramen – Large, but smaller than that of atlas.

Spinous Process – Thick, bifid, deeply grooved inferiorly.

Transverse Processes – Small, pointed; foramen oblique upwards & outwards.

Articular Surfaces:

Superior – Rest upon the body, pedicles & transverse processes in front of the notches, and are large, flat, circular, and look upwards & outwards.

Inferior – Smaller, look downwards & forwards, and are similar to those of the other cervical vertebræ.

THE SACRUM

Consists of five vertebræ blended together, sometimes of six, occasionally of four. Broad, thick, triangular, slightly curved, inclined downwards & backwards from *promontory;* broadest, least curved & most oblique in female. Presents: –

ANTERIOR SURFACE — Concave from above downwards along whole or part of its extent, slightly concave from side to side. Presents from the middle line outwards: –

Bodies of the Five Vertebræ separated by **Four Ridges.** – The bodies are flattened, and they diminish in size from above downwards. The ridges, which mark the original separations between them, lead laterally to the

Four Anterior Sacral Foramina. – These look forwards & outwards, diminish in size from above downwards, and are prolonged externally into

Four Broad & Shallow Grooves, – Which grooves give attachment to the pyriformis muscle, as do also the

Three Prominent Ridges, – Which separate them from each other.

These grooves & these latter ridges lie upon a portion of the bone sometimes called the *lateral mass,* which portion is formed by the blending of what are sometimes called the *anterior transverse processes;* these *anterior transverse processes* corresponding to the lumbar transverse processes & also to the external tubercles of the inferior dorsal transverse processes.

POSTERIOR SURFACE — Narrower, convex, uneven. Presents from the middle line outwards: –

Three or Four Tubercles – Corresponding to the three or four upper sacral spinous processes (the lower ones remaining undeveloped), which tubercles are usually more or less blended into one prominent median ridge.

A Longitudinal Groove – Corresponding to the laminæ. – These laminæ are broad & well developed superiorly, but they are nearly undeveloped inferiorly, where they merely assist in forming the lateral boundary of the inferior aperture of the sacral canal.

A Series of somewhat Indistinct Tubercles – Corresponding to the articular processes. The two lower tubercles blend together, and form, on either side of the inferior aperture of the sacral canal, the *sacral cornua,* which cornua articulate with the cornua of the coccyx.

Four Posterior Sacral Foramina – Smaller & less regular than the anterior ones.

A Series of Eminences – Which are sometimes called the *posterior transverse processes,* and which correspond to the accessory tubercles on the back of the lumbar transverse processes & to the inferior tubercles on the back of the few lower dorsal transverse processes. – Between these latter eminences & the median tubercles is comprised the *sacral groove* for origin of erector spinæ.

LATERAL SURFACES — Broad above, where they present anteriorly the

Auricular Surface – Ear-shaped, covered with cartilage for articulation with ilium, – and posteriorly

Several Deep & Rough Impressions – For posterior sacro-iliac ligaments. – Inferiorly the lateral surfaces become contracted into a

Thin Border – For sacro-sciatic ligaments & gluteus maximus muscle. This border, after presenting the prominent

Inferior Lateral Angle, – Is depressed into a

Deep Notch – For anterior division of 5th sacral nerve, which notch is further deepened by the vicinity of the transverse process of the first piece of the coccyx, and is even transformed sometimes into a complete foramen by the articulation of this transverse process with the border of the sacrum.

BASE — Broad & expanded, and looks upwards & forwards. Presents the body, pedicles, notches, laminæ, foramen, spinous, anterior & posterior transverse, & articular processes of the first sacral vertebra: –

Body – Forms part of promontory or sacro-vertebral angle.

Foramen – Large, triangular; forms superior aperture of sacral canal.

Anterior Transverse Processes – Expanded into a broad flat triangular surface continuous with iliac fossa.

Posterior Transverse Processes – Form two pointed eminences on the outer side of the articular processes.

Articular Processes – Similar to the superior articular processes of the lumbar vertebræ, but farther apart.

APEX — Curves downwards & forwards, and presents the small oval under surface of body of last sacral vertebra, which under surface articulates with corresponding part of first piece of coccyx.

SACRAL CANAL — Large & triangular above, small & flattened below, where its posterior wall is rendered incomplete by the non-development of the spines & laminæ of the one or two last sacral vertebræ. Into it open laterally both the anterior & the posterior sacral foramina.

THE COCCYX

Consists of four, sometimes of five, occasionally only of three vertebræ, which vertebræ are both incomplete and more or less rudimentary: – *incomplete*, for they are all deficient in pedicles, laminæ & spinous processes, and consequently also in spinal canal & intervertebral foramina: – *more or less rudimentary*, for the transverse & articular processes are distinguishable only in the first two or three vertebræ; the one or two last vertebræ are therefore reduced to mere nodules of bone.

The First Coccygeal Vertebra is the largest & broadest. It articulates above with the last sacral vertebra by means of the oval & concave upper surface of its body. Its transverse processes project outwards, deepening the notch for the anterior division of the 5th sacral nerve, somtimes even transforming that notch into a complete foramen by curving upwards and articulating with the lateral margin of the sacrum. Its superior articular processes are prolonged upwards into the *cornua*, which cornua articulate with the cornua of the sacrum.

The Three Lower Coccygeal Vertebræ diminish in size from above downwards. They are usually joined to each other in the adult, the primitive lines of separation between them being marked by slight transverse furrows; but up to the middle period of life the second coccygeal vertebra is frequently found separated from the first one.

At a more advanced age *all the four* bones become fused into one, which, at a still later period, especially in the male, is frequently joined to the sacrum.

The coccyx gives attachment to the coccygeus, gluteus maximus, levator ani & external sphincter muscles, and to the greater & lesser sacro-sciatic ligaments.

THE SPINE in GENERAL.

The spine consists of 33 vertebræ, *i.e.*, 7 cervical, 12 dorsal, 5 lumbar, 5 sacral, 4 coccygeal. Its average length, measured along its anterior aspect, is about 28 inches.

It presents the four following curves:

Cervical – Convex anteriorly; from odontoid process to 2nd dorsal.
Dorsal – Concave anteriorly; from 2nd to 12th dorsal.
Lumbar – Convex anteriorly; from 12th dorsal to sacro-vertebral angle.
Pelvic – Concave anteriorly; from sacro-vertebral angle to tip of coccyx.

In the dorsal region it usually presents also a slight lateral curve convex to the right, probably due to muscular action.

Its anterior, lateral, & posterior aspects, and the vertebral canal, present the following points of interest: –

ANTERIOR ASPECT — The pillar formed by the superposition of the bodies of the vertebræ may be divided with respect to the width of the bodies into the four following pyramids:

Cervical Pyramid – Broadest below; from odontoid process of axis to 1st dorsal
Superior Dorsal Pyramid – Broadest above; from 1st to 4th dorsal.
Dorso-Lumbar Pyramid – Broadest below; from 4th dorsal to last lumbar.
Sacro-Coccygeal Pyramid – Broadest above; from base of sacrum to tip of coccyx

LATERAL ASPECT — The antero-posterior diameter of the bodies increases steadily from above downwards as far as the last lumbar vertebra; it then diminishes rapidly. – The demi-facets for the ribs are seen in the dorsal region.

The pedicles are concealed in the neck by the transverse processes.

The intervertebral foramina increase in size from above downwards, and lie, in the cervical region, *between the transverse processes,* in the dorsal & lumbar regions, *in front of the transverse processes.*

The transverse processes lie, in the cervical region, *on the outer side of the pedicles & in front of the articular processes;* in the dorsal region, *behind the pedicles & behind the articular processes;* in the lumbar region, *behind the pedicles but in front of the transverse processes.* – In the dorsal region, the transverse processes, on account of their being inclined backwards, describe a greater curve than do the bodies.

The spinous processes, on the contrary, describe a lesser curve on account of their inclination downwards.

POSTERIOR ASPECT — The *spines,* though they normally occupy the median line, are sometimes deviated slightly to one side or to the other independently of disease.

The vertebral groove is *broad & shallow* in the cervical region, *narrow & deep* in the dorsal region, *narrow but rather shallow* in the lumbar region.

The distance between the laminæ is greatest in the lumbar region, least in the middle part of the dorsal.

The width between the extremities of the transverse processes is great in the atlas, but much smaller in the axis; this width increases from above downwards in the cervical region, diminishes in the dorsal region, again increases in the lumbar; it suddenly becomes very great opposite the base of the sacrum, and then diminishes rapidly throughout the sacro-coccygeal region.

VERTEBRAL CANAL — Follows the curves of the spine. It is broad & triangular in the cervical region, small & circular in the dorsal, triangular & intermediate in size in the lumbar. In the sacral region it is pretty large & triangular above, smaller & flattened from before backwards towards middle, deficient in its posterior wall below.

THE PELVIS.

Bony ring formed by the innominate bones, sacrum & coccyx, and divided into: -

FALSE PELVIS — The superior expanded portion corresponding to the iliac fossæ. Its walls are deficient in front between the anterior borders of the ilia and the bodies & horizontal rami of the pubes, and deficient also behind between the posterior superior iliac spines & the sacrum.

TRUE PELVIS — The inferior contracted portion; presents for examination: -

Superior Circumference, Brim or Inlet - Heart-shaped; bounded by crest & spine of pubes, ilio-pectineal line, anterior border of base of sacrum & sacro-vertebral angle. Looks upwards & forwards in the direction of a line drawn from middle of coccyx to umbilicus, and forms in the erect posture an angle of from 60° to 65° with the horizontal, the base of the sacrum lying about 3¾ inches above upper border of the symphysis (Nägele). Its diameters are as follows: -

Sacro-Pubic (ant.-post.) male, 4 inches; female 4½ inches;
Ilio-Iliac (transverse) „ 4½ „ „ 5¼ „
Sacro-Iliac (oblique) „ 4¼ „ „ 5 „ (Thomson & Cleland).

Cavity - Short curved canal broadest towards middle, shallow in front (1½ to 2 inches along back of symphysis pubis), deep behind (4½ to 5 inches along concavity of sacrum & coccyx). Each of its three diameters measures 4½ inches in the male, 5 or 5¼ in the female (Thomson & Cleland).

Lower Circumference or Outlet - Bounded by pubic arch, coccyx, & tuberosities of ischia. Apparently very irregular, but less so in reality, especially when considered in connexion with parturition, for the sacro-sciatic notches are bridged over in the recent state by the sacro-sciatic ligaments, and the coccyx is very movable during pregnancy and is easily pressed backwards by the head of the fœtus. Looks downwards & forwards in the direction of a line, which, prolonged upwards, would just touch the base of the sacrum; the top of the coccyx lying, on a average, in the erect posture, from 7 to 8 lines above apex of pubic arch (Nägele). Its diameters are as follows: -

Coccy-Pubic (ant.-post.) male, 3¼ inches; female 5 inches.
Bi-Ischiatic (transverse) „ 3½ „ „ 4¾ „ (Thomson & Cleland).

THE FEMALE PELVIS - As compared with the male pelvis, is lighter & more slender, and the muscular impressions on its surface are less marked. It is broader from side to side. The ilia are more expanded, and the iliac spines more widely separated. The *inlet* of the true pelvis is larger, and also more circular on account of the sacro-vertebral angle being less prominent. The *cavity* of the true pelvis is more capacious, though shallower, and the spines of the ischia project less into it. The *outlet* is more expanded & more dilatable, the pubic arch being wider, its edges more everted, the tuberosities of the ischia farther apart, and the coccyx more movable

THE RIBS.

Twelve.

Seven Sternal or True – Connected to the sternum by their costal cartilages; these increase in length from above downwards.

Five False or Asternal – Of which the three first are connected by their cartilages to the cartilage of the rib above, while the two last, or *floating ribs*, are entirely disconnected in front. The asternal or false ribs decrease in length from above downwards.

The *breadth* of the ribs decreases from the 1st to the last; so does also the width of the corresponding intercostal spaces.

The *degree of obliquity* of the ribs increases from the 1st to the 9th, and decreases from the 9th to the 12th. It is most marked between the head & the posterior angle.

The ribs are both *curved* & *twisted* upon themselves. The curve of the ribs is most marked in the neighbourhood of the posterior angle. The twist is such that the outer surface of the shaft looks slightly downwards behind & slightly upwards in front, and that, if the lower border of the shaft be placed upon a flat horizontal surface from the anterior extremity of the bone to the posterior angle, the part of the bone behind the angle, will be found to pass upwards & inwards.

COMMON CHARACTERS — A rib presents two extremities & a shaft.

POSTERIOR EXTREMITY — Presents head, neck & tuberosity.

Head – Presents:
- *two oblique facets,* a small superior one & a larger inferior one, which facets articulate with the bodies of two adjoining vertebræ, and are separated by a
- *horizontal ridge,* to which the interarticular ligament is attached.

Neck – Flattened from before backwards, about an inch in length; presents:
- *Anterior Surf.* – Smooth, continuous with inner surface of the shaft.
- *Posterior Surf.* – Rough for interosseous costo-transverse ligament.
- *Upper Border* – Has a rough crest, for superior costo-transverse ligament.
- *Lower Border* – More or less rounded.

Tuberosity – Most prominent in the upper ribs. Presents:
- *Inferior Internal, or Articular Portion* – Has a facet for the extremity of the tranverse process of the inferior of the two vertebræ with which the head is connected.
- *Superior External, or Non-articular Portion* – Rough for external costo-transverse ligament.

SHAFT — Thin & flat. Presents:

Outer Surface – Convex, on which is found posteriorly the
- *Angle, or Posterior Angle* – A rough line oblique downwards & forwards, which gives attachment to the tendons of the sacro-lumbalis, its accessory muscle, & the cervicalis ascendens, and which separates a
  - *posterior rounded portion,* giving attachment to the longissimus dorsi, and increasing in length from the 2nd rib to the 10th, and an
  - *anterior flattened portion,* smooth, looking slightly downwards behind & slightly upwards in front, which presents anteriorly the
- *Anterior Angle* – Similar to the posterior but more faintly marked.

Inner Surface – Concave, looks slightly upwards behind & slightly downwards in front, and presents inferiorly a
- *ridge* extending over the posterior two-thirds of the shaft, & most marked behind, which ridge gives attachment to the internal intercostal muscles, and forms the inner boundary of the
- *Groove* – For the intercostal vessels & nerves, which groove is deepest & most marked just in front of the angle.

Upper Border – Rounded; gives attachment to both internal & external intercostal muscles.

Lower Border – Thin & sharp. Forms outer boundary, of foregoing groove, and gives attachment to corresponding external intercostal muscle.

ANTERIOR EXTREMITY — Compressed from before backwards, presents a *deep oval pit,* studded with vascular foramina into which pit the corresponding costal cartilage is received.

PECULIAR RIBS.

Are the:

First Rib – Broad, flat, horizontal, the most curved, and usually the shortest. Its
SURFACES – Look upwards & downwards.
Upper Surface – Presents posteriorly a
rough impression for scalenus medius, and anteriorly a slightly marked *tubercle* most prominent internally, for scalenus anticus, which tubercle separates
two shallow grooves, the anterior one for the subclavian vein, the posterior one for the subclavian artery.
Under Surface – Has no ridge nor groove.
BORDERS – Are turned inwards & outwards.
Inner Border – Concave, thin; presents inner part of tubercle for scalenus anticus.
Outer Border – Convex & rounded.
HEAD – Small, rounded, with a single facet for 1st dorsal vertebra.
NECK – Short & rounded.
TUBEROSITY – Large, prominent, situated on outer border.
ANGLE – Blended with tuberosity.
ANTERIOR EXTREMITY – Large & thick.

Second Rib – Is longer, less curved, only slightly oblique, and scarcely twisted.
SURFACES – Look slightly outwards & inwards.
Outer or Upper Surface – Rough & prominent towards its middle for second & third digitations of serratus magnus; rough posteriorly for scalenus posticus.
Inner or Under Surface – Has but a short & slightly marked groove.
TUBEROSITY & ANGLE – Close together; the latter slightly marked.

Tenth Rib
HEAD – Has usually but a single articular facet.

Eleventh Rib
HEAD – But a single articular facet.
NO NECK.
NO TUBEROSITY.

Twelth Rib
HEAD – But a single anterior facet.
NO NECK.
NO TUBEROSITY.
NO ANGLE.
NO GROOVE.

The two last ribs are but slightly curved, and are short & pointed, the twelfth rib being sometimes the shortest of all.

THE COSTAL CARTILAGES.

Twelve. The *first seven* connect corresponding rib to sternum, the *three next* are join to cartilage of rib above, the *last two* are unattached in f t.

In breadth, they decrease from the first to the last, as do also the intercostal spaces.

In length, they increase from the 1st to the 7th, and then diminish from the 8th to the h.

In direction, the *first* is slightly oblique downwards, the *second* horizontal, the *third* slig ly oblique upwards; the *two last* follow the direction of the corresponding ribs; *a he others* follow this direction for a short distance, and then ascend more & more i. quely to the sternum or to the preceding cartil e.

They all *taper towards their sternal end,* excepting the two first; the sixth, seventh, eight & ninth are enlarged at their points of articulation with each ot r.

They present: –

Anterior Surface – Convex, looks upwards & forwards, – for subclavius, pectoralis maj & rhomboid or costo-clavicular ligan t.

Posterior Surface – Concave, looks downwards & backwards, – for triangularis sterni, ti s. versalis, & diaphr m.

Upper Border – Concave. For intercostals. Presents the chondro-chondral interarti ar facets in the 7th, 8th, & 9th cartil es.

Lower Border – Convex. For intercostals, internal oblique & rectus abdominis. Present he chondro-chondral interarticular facets in the 6th, 7th, & 8th cartil es.

Costal Extremity – The largest; rough & rounded, implanted into, & continuous with, ant or extremity of corresponding ib.

Anterior or Sternal Extremity – The smallest. Smooth & triangular, and fits into ste al articular notch, in the case of the 2nd, 3rd, 4th, 5th, 6th, & 7th cartilages; poi d, and joins with the cartilage above, in the case of the 8th, 9th, & 10th; point & free in the case of the 11th & 12th; enlarged and directly continuous wit he sternum in the case of th st.

THE STERNUM.

Long narrow flat bone, oblique downwards & forwards, and slightly convex anteriorly from above downwards, which constitutes the anterior abutment of the clavicle & of the seven first costal cartilages. It consists originally of six segments, of which segments the four middle ones are usually joined together in the adult, while the upper one & the lower one remain distinct till a more or less advanced age is reached. This groupment of the primitive segments gives rise to the three parts of the adult bone, which parts are from above downwards the

MANUBRIUM – The thickest part, broad above, narrow below; supports the clavicle & the first costal cartilage, and partly also the second costal cartilage.

GLADIOLUS – The longest & central part, blade-like, & broadest a little below its middle; supports the third, fourth, fifth & sixth costal cartilages, and partly also the second & the seventh ones. Is sometimes perforated by the *sternal foramen.*

ENSIFORM OR XYPHOID APPENDIX – Very variable, – broad, – pointed, – perforated, – forked, – deflected to one side or other. Partly supports the cartilage of the seventh rib. – The bone presents: –

Anterior Surface – Convex from side to side & concave from above downwards in the manubrium; flat, and marked by three transverse lines in the gladiolus, which lines correspond to the points of junction of the four middle segments, and also to the points of articulation with the gladiolus of the third, fourth, & fifth costal cartilages. – Gives attachment to sternal portion of sterno-mastoid, pectoralis major, and anterior chondro-sternal & chondro-xyphoid ligaments.

Posterior Surface – Slightly concave, smoother; marked in the gladiolus by three transverse lines corresponding to, but less distinct than, those on the anterior surface. Gives attachment to sterno-hyoid & -thyroid, triangularis sterni, median fasciculus of diaphragm, and posterior chondro-sternal ligaments.

Superior Border – Thick; presents in the centre the

Interclavicular Notch, – and laterally the

Clavicular Facets – Convex from before backwards, concave from above downwards & outwards; articulate with the interarticular fibro-cartilage of the sterno-clavicular articulation.

Lateral Borders – Present seven costal articular depressions separated by six intervening scallops, which latter diminish in breadth from above downwards. The seven articular depressions are situated as follows: – the *first* one on the side of the manubrium just below the clavicular facet; the *second* one at the point of articulation between the manubrium & the gladiolus (it therefore presents two facets); the *third, fourth & fifth* ones on the sides of the gladiolus opposite the points of junction of its four primitive segments; the *sixth* one on the side of the last segment of the gladiolus; the *seventh* one at the point of articulation between the gladiolus & the ensiform appendix.

Apex – Formed by the ensiform appendix; gives attachment to linea alba, anterior abdominal aponeurosis & innermost fibres of rectus abdominis muscle.

THE THORAX in GENERAL.

Conical with convex walls and axis oblique downwards & forwards; broadest below & from side to side; bounded by dorsal portion of spine, ribs, costal cartilages & sternum. Presents for examination: -

OUTER SURFACE — Convex. Presents: -

Anterior Aspect - Oblique downwards & forwards, 8½ inches in height. Presents sternum, costal cartilages, & front part of ribs, which latter present their anterior angles disposed in a line oblique downwards & outwards.

Posterior Aspect - Twelve inches in height, depressed centrally, convex on either side. Presents: -

In Middle Line - Spines, vertebral grooves, transverse processes, costo-transverse articulations; -

Laterally - Prominent convexity of posterior part of ribs, which convexity increases in breadth from above downwards, and is bounded externally by the posterior angles of the ribs disposed in a line oblique downwards & outwards

Lateral Aspect - Oblique, rounded, thirteen inches in height, most convex posteriorly. *In length* the ribs & the costal cartilages increase from the 1st to the 7th, and decrease from the 8th to the 12th; the intercostal spaces increase from the 1st to the 5th only, and then decrease from the 6th to the 11th. The *widt* of the ribs & intercostal spaces decreases from the 1st to the last, the width o the latter being greatest in front. The degree of *obliquity* of the ribs increase from the 1st to the 9th, and decreases from the 9th to the 12th; it is mos marked behind

SUPERIOR APERTURE or APEX — Narrow, heart-shaped, oblique downwards & forwards, bounded by the sternum, first dorsal vertebra, first rib & first costal cartilage

INFERIOR APERTURE or BASE — Expanded from side to side, widest toward middle, and, from before backwards, diminished behind by prominence of body of las dorsal vertebra, and greatly increased in front by being prolonged upwards & forwards between the asternal ribs & their cartilages as far as the ensiform appendi

INTERNAL CAVITY — Broadest from side to side, narrowed from before backwards i middle line, and partly divided posteriorly into two, by the incomplete septum forme by bodies of vertebræ, on either side of which bodies it is prolonged backwards so as t form two deep grooves widest belo

THE FRONTAL BONE

Articulates with sphenoid & ethmoid, and with both parietal, nasal, superior maxillary, lachrymal & malar.

Divided into vertical or frontal, and horizontal or orbito-nasal portions.

VERTICAL OR FRONTAL PORTION — Presents:

Ext. Surface – Presents in median line:

Median suture, usually obliterated a few years after birth, and below which is the

Nasal eminence; – and laterally from above downwards:

Frontal eminence;

Superciliary ridge caused by projection of frontal sinuses, broad inwardly where it joins the nasal eminence;

Supraorbital arch, presenting at its inner third the

Supraorbital notch or foramen, for supraorbital vessels & nerve, – and which arch terminates externally and internally in the external & internal angular processes.

EXT. ANGULAR PROCESS – Thick & strong; articulates with malar bone, and presents externally a part of the

Temporal ridge.

INT. ANGULAR PROCESS – Thinner; articulates with lachrymal bone, and bounds the

Nasal notch, which articulates with nasal bones & nasal processes of superior maxilla, and presents below the

Nasal spine.

Int. Surface – Concave. Presents in median line and from below upwards:

Foramen cœcum (completed behind by ethmoid) for small vein to longitudinal sinus and a process of falx cerebri;

Frontal crest, which is continued into

Groove for longitudinal sinus & falx cerebri; – and laterally

Cerebral impressions and

Grooves for branches of anterior & middle meningeal arteries.

HORIZONTAL OR ORBITO-NASAL PORTION — Consists of the two orbital plates separated by the ethmoidal notch.

ORBITAL PLATES — Present:

Under Surface – Concave, on which are seen externally the

Lachrymal fossa for lachrymal gland, and internally the

Fovea trochlearis for pulley of superior oblique.

Upper Surface – Convex, forms part of anterior fossa of base of skull, and presents well marked cerebral impressions.

ETHMOIDAL NOTCH – Is filled up by horizontal plate of ethmoid. – The under surface of its margin presents:

Several half-cells, which complete & close the ethmoidal cells, and

Two grooves, which form part of

Anterior ethmoidal canal for nasal n. & ant. ethmoidal vessels, and of

Posterior ethmoidal canal for posterior ethmoidal vessels.

In front of the ethmoidal notch is the

Nasal spine, which articulates with nasal bones & perpendicular plate of the ethmoid and forms part of roof of nose, and on the sides of which are the

Openings of the frontal sinuses

The circumference of the bone is thick in the vertical or frontal portion, where it is serrated for articulation with the parietals, and is bevelled at the expense of the inner table, above, of the outer table, below. In the horizontal portion the circumference is thin & serrated for articulation with the lesser wing of the sphenoid. At the junction of the two portions of the bone the circumference presents a large triangular rough surface for articulation with the greater wing of the sphenoid.

THE PARIETAL BONE

Articulates with its fellow, the occipital, temporal, sphenoid & frontal. – Presents:

OUTER SURFACE — Convex, and presents:
Parietal foramen at upper & back part;
Parietal eminence;
Temporal ridge, below which it forms part of temporal fossa.

INNER SURFACE — Concave, and presents:
Cerebral eminences & depressions;
Furrows, for ramifications of middle meningeal artery;
Half-groove for superior longitudinal sinus & falx cerebri;
Depressions for Pacchionian bodies.

BORDERS — Four:
Superior – Form sagittal suture by articulating with each other;
Inferior – Are:
In Front – Bevelled externally & overlapped by great wing of sphenoid & squamous portion of temporal;
Behind – Serrated for articulation with mastoid portion of temporal.
Anterior – Serrated, and form coronal suture by articulating with frontal.
Posterior – Serrated, and form lambdoid suture by articulating with occipital.

ANGLES — Four:
Anterior Superior & Posterior Superior – Correspond to anterior & posterior fontanelles, and form part of foregoing sutures.
Anterior Inferior – Received between frontal & great wing of sphenoid, an inch above and behind superior external angle of orbit. – Is grooved internally and sometimes chanelled for anterior branch of middle meningeal artery.
Posterior Inferior – Articulates with mastoid portion of temporal, and presents part of groove for lateral sinus.

THE OCCIPITAL BONE

Articulates with parietals, mastoid & petrous portions of temporals, sphenoid & atlas, and presents:

OUTER SURFACE — Convex. Presents from behind forwards:

Ext. occipital protuberance for ligamentum nuchæ;
Ext. occipital crest, from which are given off laterally the
  Sup. curved line, for trapezius, sterno-mastoid & occipito-frontalis; and the
  Inf. curved line for recti capitis postici major & minor which are also inserted into depression below. – Between the two curved lines are inserted the complexus, splenius & superior oblique.
Foramen magnum for cord and its membranes, spinal accessory nerves & vertebral arteries, on outer side of which foramen are the
  Condyles, oblong, converging in front, convex from before backwards, looking downwards & outwards; rough inwardly for attachment of check ligaments, and having in front
    Ant. condyloid foramen for hypoglossal nerve; having behind
    Post. condyloid fossa sometimes perforated by posterior condyloid foramen for a small vein to lateral sinus, and having on their outer side the
    Jugular process for rectus capitis lateralis & lateral occipito-atloid ligament;
Basilar process presenting in middle line the
  Pharyngeal spine for tendinous raphe & superior constrictor of pharynx, and laterally a
  Rough depression for recti capitis antici major & minor.

INNER SURFACE — Concave, presents from behind forwards:

Crucial ridge, to centre of which corresponds the torcular Herophili, and of which the
  Upper division ascends to superior angle, and is deeply grooved for superior longitudinal sinus & falx cerebri;
  Inf. division, or int. occipital crest, descends to foramen magnum where it bifurcates; gives attachment to falx cerebelli.
  Lateral divisions bound posteriorly the inferior occipital fossæ, and are deeply grooved for lateral sinuses & tentorium cerebelli;
Foramen magnum, near side of which are the
  Ant. condyloid foramina & sometimes the
  Post. condyloid foramina.
Basilar groove, which supports medulla oblongata & pons, and on each side of which is a half
  Groove for inferior petrosal sinus.

BORDERS — Four:

Superior – Form lambdoid suture by articulating with parietals.
Inferior – Articulate with mastoid & petrous portions of temporal, and assist in forming jugular foramen or foramen lacerum posterius.

ANGLES — Four:

Superior – Received between the two parietal bones, and corresponds to posterior fontanelle.
Inferior – Joins with body of sphenoid about 18th or 20th year.
Lateral – Received between posterior inferior angle of parietal and mastoid portion of temporal; presents on its inner surface outer end of groove for lateral sinus.

THE TEMPORAL BONE

Is situated at side of base of skull, and articulates with *parietal, occipital, sphenoid, malar & inferio maxillary bones*

Is divided into squamous, mastoid & petrous portions.

SQUAMOUS PORTION — Presents outer & inner surfaces and circumference.

Outer Surface — Convex, forms part of temporal fossa and presents lower part o *temporal ridge* behind, *zygomatic process* in front, and *glenoid fossa* below

ZYGOMATIC PROCESS — First projects outwards, and is broad & flattened from above downwards. It then twists forwards and presents

Borders – *upper* long & thin for temporal f.; *lower* short & thick for masseter.

Surfaces – *outer* convex, *inner* concave also for masseter.

Apex – Serrated, articulates with malar bone.

Base – Presents *three roots:*

Anterior – Wide & transversely directed forming *eminentia articularis;*

Middle – Forms posterior boundary of glenoid fossa;

Posterior – Forms origin of temporal ridge.

GLENOID FOSSA — Is comprised between anterior & middle roots of the zygoma and presents th

Glaserian Fissure – For processus gracilis of malleus, laxator tympani m., tympanic artery, and divides the fossa int

Anterior part – Articular, and covered with cartilage which is prolonge over the eminentia articulari

Posterior part – Non-articular, bounded behind by vaginal & auditor processes & middle root of zygom

Inner Surface — Concave. Presents cerebral impressions, and grooves for midd meningeal arter

Circumference — Thin above and behind, where it is bevelled internally and articulate with parietal; thick in front, where it is slightly bevelled externally an articulates with great wing of spheno

MASTOID PORTION — Presents outer & inner surfaces and borders.

Outer Surface — Rough; presents:

Mastoid foramen for a vein to lateral sinus, and is prolonged into

Mastoid process for insertion of sterno-mastoid, splenius capitis & trachelo-mastoi and on the inner side of which is th

Digastric groove for origin of posterior belly of digastric, and further inwards th

Occipital groove for occipital artery.

Inner Surface — Forms part of posterior fossa of base of skull and presents descendi portion

Groove for lateral sinus.

Borders - Post. & Sup. — Thick & serrated for posterior inferior angle of pariet and lower border of occipit

PETROUS PORTION — Vide next Tablet.

PETROUS PORTION of the TEMPORAL BONE.

Pyramidal, directed forwards & inwards and wedged in between the sphenoid & the basilar process of the occipital. Presents:

Base — Its exposed part presents the
Meatus auditorius externus, the lower part of which is surrounded by the
Auditory process, to which is attached the cartilage of the pinna.

Apex — Presents the
Internal orifice of the carotid canal; and forms the posterior & outer boundaries of the foramen lacerum medium.

Ant. Surface — Forms posterior boundary of middle fossa of base of skull, and presents from before backwards & outwards the:
Internal orifice of the carotid canal,
Depression for Gasserian ganglion,
Hiatus Fallopii with *a groove leading to it,* both for large superficial petrosal nerve and petrosal branch of middle meningeal artery, and near which hiatus are frequently seen
Two or three other small foramina for small superficial petrosal nerve, petrosal branch of glosso-pharyngeal & branch of glosso-pharyngeal to large superficial petrosal nerve.
Eminence corresponding to the superior semi-circular canal, on the outer side of which is a
Depression corresponding to the cavity of the tympanum.

Post. Surface — Forms anterior boundary of posterior fossa of base of skull, and presents:
Meatus auditorius internus for facial nerve and auditory artery & nerve;
Opening of Aqueductus Vestibuli for small artery & vein to vestibule & a process of the dura mater.

Inf. or Basilar Surface — Presents in a diagonal line from before backwards & outwards:
Rough surface for origin of levator palati & tensor tympani;
Inferior orifice of carotid canal;
Vaginal process which embraces root of
Styloid process, which gives attachment from above downwards to the stylo-pharyngeus, -hyoideus & -glossus muscles, and to the stylo-hyoid & -maxillary ligts.,
Stylo-mastoid foramen for facial nerve & stylo-mastoid artery. – Behind & on inner side of the carotid canal & vaginal process are the
Jugular surface, which articulates with jugular process of occipital, and the
Jugular fossa for sinus of internal jugular vein, which fossa assists in forming jugular foramen or foramen lacerum posterius, and has near to it:
Opening for Arnold's nerve, on its outer wall,
Opening for Jacobson's nerve, in front, on bony ridge between it & carotid canal,
Opening of Aqueductus Cochleæ, in front & to inner side, close to posterior border of the petrous bone.

Borders — Three:
SUPERIOR – Grooved for superior petrosal sinus & attachment of tentorium cerebelli.
POSTERIOR – Grooved in front for inferior petrosal sinus; presents jugular fossa behind.
ANTERIOR – Its INNER PART articulates with spine of sphenoid; its OUTER PART is joined by a suture to the squamous portion of the bone. In the angle of junction of these two portions are found the
Canal for the tensor tympani muscle above, and the
Osseous portion of the Eustachian tube below, on the outer side of which latter opening is the
Canal of Huguier for exit of chorda tympani.

THE SPHENOID BONE

Is situated at front part of base of skull, and articulates with the 7 other cranial bones & with vomer & both malar & palate bones. Presents for examination :

BODY — Is cuboid, but presents only four free surfaces, the two lateral surfaces being continuous with the wings & pterygoid processes.

UPPER SURFACE — Presents from before backwards:

Ethmoidal spine, which articulates with ethmoid;
Smooth surface slightly elevated in median line, and which supports olfactory nerves;
Optic groove leading laterally to optic foramen;
Olivary process ;
Pituitary fossa or sella turcica bounded laterally & in front by middle clinoid processes;
Dorsum sellæ notched laterally for 6th pair of cranial nerves, and presenting posterior clinoid processes at its superior angles. On each side of body is the
Cavernous groove curved like an italic *S* for internal carotid artery.

ANTERIOR SURFACE — Presents in middle line the

Sphenoidal crest, which articulates with perpendicular plate of ethmoid; on either side the
Openings of the sphenoidal sinuses, which are partly closed in front by the
Sphenoidal turbinated bones or bones of Bertin. – This surf. articulates laterally with os planum of ethmoid, and inferiorly with orbital process of palate bone.

UNDER SURFACE — Presents in middle line the

Rostrum, which is received between the alæ of the vomer, and is continuous anteriorly with sphenoidal crest; on each side of the rostrum is the
Vaginal process, which passes inwards beneath, and articulates with, the alæ of the vomer, and externally to which is the
Pterygo-palatine groove, which forms pterygo-palatine canal with sphenoidal process of palate bone.

POSTERIOR SURFACE — Articulates with basilar process of occipital bone, with which it unites at age of 18 or 20.

GREATER WINGS — Present:

SUPERIOR or CEREBRAL SURFACE — Forms part of middle fossa of base of skull, and presents from before backwards at its inner part:

Foramen rotundum for superior maxillary nerve;
Foramen ovale for inferior maxillary & small petrosal nerves & small meningeal artery, on the inner side of which latter foramen is sometimes seen the
Foramen Vesalii for a small vein;
Foramen spinosum for middle meningeal artery.

EXTERNAL SURFACE — Is divided by pterygoid ridge into:

Superior part, which enters into formation of temporal fossa, and
Inferior part, which assists in forming zygomatic fossa, and presents posteriorly
Spine of sphenoid for internal lateral ligament of jaw & laxator tympani muscle.

ANTERIOR or ORBITAL SURFACE — Quadrilateral; assists in forming outer wall of orbit and sphenoidal & spheno-maxillary fissures, and articulates with frontal & malar bones. Presents a small spine for lower head of external rectus.

CIRCUMFERENCE.

From Back of Body to Spine – Forms anterior or outer margin of foramen lacerum medium, in front, and articulates, behind, with petrous portion of temporal b.
From Spine to Tip – Articulates with squamous portion of temporal bone, being bevelled internally below, externally above.
From Tip to Front of Body – Presents externally a broad triangular surface for frontal bone, and forms, internally, lower boundary of sphenoidal fissure.

LESSER WINGS or PROCESSES of INGRASSIAS — Long, thin, triangular:

UPPER SURFACE — Smooth, forms part of anterior fossa of base of skull;
UNDER SURFACE — Forms back of roof of orbit and upper boundary of sphenoidal fissure, which latter is bounded internally by body of sphenoid, and transmits 3rd, 4th & 6th nerves, and ophthalmic nerve & vein.
ANTERIOR BORDER — Articulates with frontal bone;
POSTERIOR BORDER — Forms at its inner extremity the anterior clinoid process.
INNER EXTREMITY — Presents two roots which bound optic foramen.

PTERYGOID PROCESS — Consists of two plates which bound pterygoid fossa, and are separated below by a triangular notch filled up by pterygoid process of palate bone. – Its

ANTERIOR SURFACE — Forms posterior wall of spheno-maxillary fossa, and presents anterior orifice of vidian canal.

EXTERNAL PTERYGOID PLATE — Broad, thin, inclined outwards. Forms inner & outer walls of zygomatic & pterygoid fossæ respectively, and gives attachment to internal & external pterygoid muscles.

INTERNAL PTERYGOID PLATE — Narrower & longer. Its

Outer & inner surfaces – Form respectively inner boundary of pterygoid fossa & outer boundary of posterior nares. At its apex it presents
Hamular process for reflection of tendon of tensor palati and at its base
Scaphoid fossa for origin of that muscle.

THE ETHMOID BONE.

Light, spongy, cuboid, projects downwards from between orbital plates of frontal, and enters into formation of orbits & nasal fossæ.
Articulates with *frontal, sphenoid & sphenoidal turbinated bones, both nasal, superior maxillary, lachrymal, palate, inferior turbinated & vomer.*
May be divided into three parts :

HORIZONTAL OR CRIBRIFORM PLATE — Received into ethmoidal notch of frontal.
Forms part of roof of nose & of anterior fossa of base of skull, and presents in the median line the
Crista galli, which gives attachment to falx cerebri, and articulates below & in front with frontal bone, completing foramen cœcum; – and on each side
Three rows of foramina for branches of the olfactory nerve, and more anteriorly a
Fissure for nasal branch of ophthalmic nerve.

PERPENDICULAR PLATE — Descends from under surface of former, and assists in forming nasal septum.
Is more or less inclined to one or other side, and presents numerous grooves for branches of olfactory nerve.
Articulates in front with frontal spine and nasal bones, behind with crest of sphenoid & vomer, and joins below with triangular cartilage of nose.

LATERAL MASSES — Cuboid, and enclose a number of irregular cavities, the ethmoid cells, which are divided into an anterior & a posterior set. Their
Anterior, Upper & Posterior Surfaces – Present numerous half-cells, which are completed respectively by articulation with
Lachrymal bones & nasal processes of superior maxilla,
Frontal bone,
Sphenoidal turbinated bones & orbital processes of palate bones. – The upper surface also presents two grooves which assist in forming the anterior & posterior ethmoidal foramina.
Outer Surface – Presents a thin smooth plate of bone the *os planum* which forms inner wall of orbit, and articulates with :
Lachrymal bone, in front;
Orbital plate of frontal, above;
Body of sphenoid, behind;
Superior maxillary & orbital process of palate bone, below.
Under Surface – Presents under surface of middle turbinated process and the projecting
Unciform process, which articulates with inferior turbinated bone, and assists in forming inner wall of the antrum of Highmore.
Inner Surface – Forms part of outer wall of nasal fossæ, and presents from above downwards the
Superior turbinated process, small and corresponding to post. part of nasal fossæ;
Superior meatus, which communicates with posterior ethmoidal cells;
Middle turbinated process, which extends along whole length of lateral mass;
Middle meatus, which communicates with the anterior ethmoidal cells (and through these with the frontal sinus) by means of a wide funnel-shaped canal, the
Infundibulum.

INNER SURFACE of the BASE of the SKULL

Presents three fossæ.

ANTERIOR FOSSA — The highest.

Formed by orbital plates of frontal, cribriform plate of ethmoid, lesser wings and front part of upper surface of body of sphenoid.

Presents the sutures between the foregoing bones, and in median line and from above downwards and then backwards:

Front part of groove for superior longitudinal sinus,
Frontal crest,
Foramen cæcum,
Crista galli,
A slightly elevated ridge.

On the side of the two latter is the

Olfactory groove deep in front, where it is formed by cribriform plate of ethmoid, and presents

Three rows of foramina for olfactory nerves,
Slit-like opening for nasal nerve,
Anterior & posterior ethmoidal foramina for nasal nerve and anterior & posterior ethmoidal arteries.

MIDDLE FOSSA — Vide next Tablet.

POSTERIOR FOSSA — The deepest.

Formed by occipital, petrous & mastoid portions of temporal and posterior inferior angle of parietal, and bounded in front by dorsum sellæ & superior border of petrous bones, and behind, by grooves for lateral sinuses.

Presents the sutures between the foregoing bones, and in the centre:

Foramen magnum for cord and its membranes, spinal accessory nerves & vertebral arteries.

In Front of the Foramen Magnum is the

Basilar groove, which supports medulla oblongata & pons, and on the sides of which are the *petro-occipital sutures,* which are grooved in front for inferior petrosal sinuses and expanded behind into jugular foramen or foramen lacerum posterius.

Behind the Foramen Magnum is the

Internal occipital crest, which separates the two
Inferior occipital fossæ, and ends in the
Internal occipital protuberance, which is situated at point of junction of the
Grooves for lateral sinuses, and to which corresponds the torcular Herophili.

On the Sides of Foramen Magnum are the

Anterior condyloid foramina for hypoglossal nerves, and, occasionally, the
Posterior condyloid foramina for a small vein to lateral sinus;
Jugular foramen or foramen lacerum posterius, of which the
Anterior or inner part, smaller and separated from the remainder by a bony ridge, gives passage to glosso-pharyngeal, pneumogastric & spinal accessory nerves, while the
Posterior part, larger, transmits the internal jugular vein;
Posterior surface of petrous portion of temporal bone presenting
Internal auditory meatus for facial nerve and auditory artery & n.,
Slit-like aperture of Aqueductus Vestibuli for small artery & vein and a process of dura mater.

MIDDLE FOSSA of the BASE of the SKULL

Is narrow in median line & expanded laterally.

Is formed by body & greater wings of sphenoid, squamous portion and anterior surface of petrous portion of temporal and anterior inferior angle of parietal, and is bounded by lesser wings of sphenoid & anterior margin of optic groove, in front, and by superior border of petrous bones behind.

Presents the sutures between foregoing bones and

In Median Line from before backwards:

Optic groove leading on either side to
  Optic foramen for optic nerve & ophthalmic artery,
Olivary process,
Sella turcica on each side of which is the
  Cavernous groove,
Dorsum sellæ presenting at its upper angles the
  Posterior clinoid processes.

Laterally:

Cerebral eminences & depressions, and *grooves* for middle meningeal artery; and more internally, and from before backwards:
Sphenoidal fissure or foramen lacerum anterius for 3rd, 4th & 6th nerves, and ophthalmic nerve & vein,
Foramen rotundum for superior maxillary nerve,
Foramen ovale for inferior maxillary & small superficial petrosal nerves and small meningeal artery, (on inner side of which latter foramen is sometimes seen
  Foramen Vesalii for a small vein),
Foramen spinosum for middle meningeal artery,
Foramen lacerum medium closed with cartilage.

On Anterior Surface of Petrous Bone:

Internal orifice of carotid canal,
Depression for Casserian ganglion,
Grooves to Hiatus Fallopii for large superficial petrosal nerve and to a smaller and more external opening for small superficial petrosal nerve; frequently
Two other small foramina for small petrosal branch of glosso-pharyngeal and branch of glosso-pharyngeal to large superficial petrosal nerve,
Eminence corresponding to superior semi-circular canal, on outer side of which is a
Depression corresponding to cavity of tympanum.

THE PALATE BONE

Presents *horizontal* and *vertical plates*, –from the point of junction of which two plates the *pterygoid process* projects backwards & outwards, –while from the upper border of the vertical plate project upwards, the *orbital process* in front, and the *sphenoidal process* behind.

It articulates with *its fellow, the superior maxilla, sphenoid, ethmoid, inferior turbinated & vomer.*

It assists in forming –principally, the *floor & outer wall of the nasal fossa and the roof of the mouth*, and –secondarily, the *floor of the orbit, the pterygoid & spheno-maxillary fossæ, and the inner wall of the Antrum of Highmore.*

HORIZONTAL PLATE — Presents:

Sup. or Nasal Surface – Smooth and concave from side to side, forms posterior part of floor of nasal fossa.

Inf. or Buccal Surface – Rough, marked posteriorly by a

Transverse ridge for attachment of aponeurosis of tensor palati, and more externally by a

Deep notch, which assists in forming the posterior palatine foramen. A little further back, on the under surface of the pterygoid process, are the

External & posterior small palatine foramina for external and posterior palatine nerves.

Anterior Border – Serrated for articulation with palate process of superior maxilla.

Posterior Border – Free for attachment of soft palate.

Inner Border – Thick, surmounted by a ridge, which forms with its fellow a groove for vomer; presents posteriorly the

Posterior nasal spine for azygos uvulæ.

VERTICAL PLATE — Presents:

Inner Surface – Presents the

Superior & middle turbinated crests, above, between & below which are seen

A narrow & two wider horizontal grooves, which form part respectively of the superior, middle & inferior meatuses.

Outer Surface – Presents towards its middle a

Smooth surface, which forms the inner wall of the spheno-maxillary fossa, and is prolonged inferiorly into a

Vertical groove, which assists in forming the posterior palatine canal. In front of these is a

Rough surface, which articulates with the superior maxilla; and further forwards still a

Narrow smooth surface, which forms part of inner wall of antrum. Behind is a

Rough surface, which articulates above with the pterygoid process of the sphenoid, below with the superior maxilla.

Anterior Border – Thin, irregular, presents a projecting lamina, the

Maxillary process, which assists in closing the lower part of the orifice of the antrum, and, forming a schindylesis, penetrates into a fissure of the superior maxilla at the lower part of that orifice.

Posterior Border – Articulates with the inner plate of the pterygoid process.

Upper Border – Presents the

Orbital process in front, the *Sphenoidal process* behind, which processes are separated by a deep

Notch forming the greater part of the spheno-palatine foramen (which foramen is completed above by the sphenoidal turbinated bone).

PTERYGOID PROCESS — Fits into the notch between the two plates of the pterygoid process of the sphenoid bone, and presents:

Posterior Surface – Triangular, concave, forms part of pterygoid fossa.

Two Lateral Surfaces – Rough, articulate with the two plates of the pterygoid process & with the superior maxilla.

Under Surface – Forms part of the roof of the mouth, and presents the

External & posterior small palatine foramina for external & posterior palatine nerves.

ORBITAL PROCESS — Projects upwards & outwards from the anterior part of the upper border of the vertical plate, and presents:

Three articular Surfaces – *Anterior, posterior & internal,* – which join respectively with the *superior maxillary bone, the sphenoidal turbinated bone & the lateral mass of the ethmoid.*

Two Non-articular Surfaces:–

Superior or Orbital – Forms posterior part of floor of orbit;

External or Spheno-maxillary – Forms part of inner wall of spheno-maxillary fossa, and is separated from the foregoing by a

Rounded border, which forms part of spheno-maxillary fissure.

SPHENOIDAL PROCESS — Curves upwards, backwards & inwards, and presents:

Upper Surface – Articulates with sphenoid & sphenoidal turbinated bones, and assists in forming pterygo-palatine canal.

Outer Surface – Articulates behind with pterygoid process, and forms in front that small part of inner wall of spheno-maxillary fossa, which lies behind spheno-palat. foramen.

Inner Surface – Concave, forms part of outer wall of nasal fossa.

NFERIOR MAXILLARY BONE

Is curved upon itself, and consists of a middle horizontal portion, the body, and of two lateral vertical portions, the rami.

BODY — Presents:

EXT. SURFACE — Convex from side to side and concave from above downwards. Presents in median line the

Symphysis, a vertical ridge, at the lower part of which is the

Mental process, from which the

External oblique line passes backwards, first horizontally, giving attachment to depressores labii inferioris & anguli oris, and then obliquely & becoming continuous with anterior border of ramus. – Laterally above the oblique line is the

Incisive fossa for levator menti; and more externally the

Mental foramen for mental vessels & nerve.

The Buccinator is attached above oblique line behind, and the platysma, below it, in front.

INT. SURFACE — Concave from side to side and convex from above downwards. Presents the

Symphysis forming a linear depression, close to which near its middle are the superior & inferior pairs of

Genial tubercles giving attachment respectively to the genio-hyo-glossi & genio-hyoidei. Below these tubercles begins the

Internal oblique line or *mylo-hyoid ridge* for mylo-hyoid muscle, faintly marked at first, but becoming more distinct as it passes upwards & backwards. – Above & below this line are seen near the symphysis the

Sublingual fossa for sublingual gland;

Rough depression for anterior belly of digastric; and more externally

Submaxillary fossa for submaxillary gland.

Above posterior extremity of mylo-hyoid ridge is attached the superior constrictor of the pharynx.

SUP. BORDER — Thickest behind, where it is dejected inwards; presents sixteen alveolæ in the adult, ten in the child.

INF. BORDER — Thickest and slightly everted anteriorly.

RAMI — Are quadrilateral, and present:

EXT. SURFACE — Marked by oblique ridges for masseter.

INT. SURFACE — Presents near middle

Aperture of inferior dental canal, of which the anterior margin forms a prominent

Spine for internal lateral ligament of lower jaw; – and from which passes downwards & forwards the

Mylo-hyoid groove for mylo-hyoid vessels & nerve, behind which groove is a

Rough surface for internal pterygoid muscle.

UPPER BORDER — Presents the coronoid & condyloid processes separated by sigmoid notch.

Coronoid process – Triangular, gives attachment by its surfaces & borders to temporal muscle, and presents at its lower & front part a groove which is continued downwards upon the alveolar process, and which gives attachment inferiorly to the buccinator muscle.

Condyloid process – Consists of

Condyle – Oblong, convex from side to side and from before backwards & nearly transverse, its long axis when prolonged, meeting that of its fellow near anterior margin of foramen magnum.

Neck – Flattened from before backwards, convex behind, excavated in front for external pterygoid muscle, presenting externally a tubercle for external lateral ligament of jaw.

ANTERIOR BORDER — Continuous with external oblique line; thin above, thicker below where grooved for buccinator.

LOWER & POSTERIOR BORDERS — Thick and form inferiorly the

Angle of the jaw, which gives attachment to masseter & internal pterygoid muscles and to stylo-maxillary ligament.

SUPERIOR MAXILLARY BONE – 1st Tablet.

Forms the whole of upper jaw by its union with its fellow.
Assists in forming :
Roof of mouth, floor & outer wall of nose, floor of orbit ;
Zygomatic & spheno-maxillary fossæ ;
Spheno-maxillary & pterygo-maxillary fissures.
May be described as presenting a body and four processes, malar, nasal, alveolar & palate.

BODY — Hollowed out to form Antrum of Highmore. – Presents :

OUTER SURFACE — Convex. Presents from within outwards & backwards :
Incisive or myrtiform fossa for depressor alæ nasi,
Canine fossa, large & deep for origin of levator anguli oris & compressor na at upper part of which fossa is
Infra-orbital foramen for infra-orbital vessels & nerve ;
Vertical ridge, which descends from malar process, and behind which is the
Maxillary tuberosity, which is rough along its posterior border for articulati with the palate bone & sometimes with pterygoid process of spheno

INNER SURFACE — Divided into two unequal parts by palate process.
PART ABOVE PALATE PROCESS – Presents from before backwards the
Inferior turbinated crest, above and below which are
Two wide antero-posterior grooves, which form part of middle & infer meatuses, and the former of which is surmounted by
Superior turbinated crest, which lies on inner surface of nasal process
A deep groove which is converted into nasal duct by articulation with chrymal & inferior turbinated bon
Aperture of Antrum of Highmore very large in disarticulated bone diminished in articulated skull by ethmoid, lachrymal, infer turbinated & palate bones, and presenting inferiorly a fiss into which is received the maxillary process of the palate bo
A rough surface which articulates with palate bone and is divided into anterior & a posterior portion b
Vertical groove, which forms part of posterior palatine canal.
PART BELOW PALATE PROCESS – Forms anterior part of roof of mouth.

UPPER SURFACE — Forms greater part of floor of orbit, and is bounded :
On Inner Side – By a thin edge which articulates from before backwa with lachrymal bone, os planum & orbital process of palate bo
On Outer Side – By a rounded margin which forms part of sphe maxillary fissu
in Front – By lower part of circumference of orbit. – It presents behi
Infra-orbital groove for infra-orbital vessels & nerve, which groove becomes c verted in front i
Infra-orbital canal ; – and at its anterior & inner part a
Depression for inferior oblique muscle.

Antrum of Highmore or Maxillary Sinus – Is a large cavity hollowed out body of the superior maxillary bo
Its walls correspond to the three surfaces of the body of the bone; they very thin, and contain the infra-orbital & ant .& post. dental can
Its aperture communicates with the middle meatus of the nasal fossæ, and much diminished in size, and generally divided into two by arti lation with ethmoid, lachrymal, inferior turbinated & palate bon
Several laminæ of bone project into its cavity, as do also the roots of the & 2nd molar teeth, which sometimes perforate its flo

SUPERIOR MAXILLARY BONE—2nd Tablet.

MALAR PROCESS — Triangular, and presents:

Ant. Surface - Concave, forms part of canine fossa;
Post. Surface - Concave, forms part of zygomatic fossa;
Sup. Surface - Rough for articulation with malar bone.

NASAL PROCESS — Triangular, and presents:

Outer Surface - Concave, gives attachment to orbicularis palpebrarum, tendo oculi, levator labii superioris alæque nasi.

Inner Surface - Presents from above downwards:
Rough surface, which articulates with ethmoid bone;
Superior turbinated crest which articulates with middle turbinated bone;
Inferior turbinated crest with the two grooves already described.

Ant. Border - Thin, serrated above for articulation with nasal bone, and continuous below with margin of the deep notch, which bounds laterally the anterior aperture of the nasal fossæ.

Post. Border - Presents a groove which forms part of nasal duct, of which groove the
Inner margin articulates with lachrymal bone, while the
Outer margin forms part of circumference of orbit, and presents the
Lachrymal tubercle at its junction with orbital surface.

ALVEOLAR PROCESS — Forms a curve of a semi-horse-shoe shape. Is thicker behind than in front, and presents eight alveoli in adults, five in children.

PALATE PROCESS — Presents:

Upper Surface - Concave from side to side. Forms part of floor of nasal fossa, and presents in front the
Incisor foramen or *foramen of Stenson,* which is completed on its inner side by a thin lamina of bone directed backwards from its anterior to its posterior border (from the latter of which this lamina remains disconnected in youth). This foramen leads below into the
Anterior palatine canal formed by the junction of the two bones, into which canal when it is viewed from below, are also seen to open two other small foramina, the
Foramina of Scarpa situated in the suture between the two laminæ.—The foramina of Stenson transmit the anterior palatine vessels, while the foramina of Scarpa transmit the naso-palatine nerves, of which the right one is said to be posterior to the left.

Under Surface - Concave, rough, forms part of roof of mouth.—Is channelled by a
Groove (sometimes by a canal) for the posterior palatine vessels & anterior or great palatine nerve, and presents behind anterior part of lower orifice of
Posterior palatine canal.

Inner Border - Raised into a ridge which forms with its fellow a groove for vomer, and presents in front the
Anterior nasal spine.

Ant. Border - Forms lower part of anterior aperture of nasal fossæ.

Post. Border - Articulates with horizontal plate of palate bone.

THE SMALL BONES of the FACE.

NASAL BONES — Form bridge of nose. – Narrow & thick above, wide and thin below. Present:

Outer Surface – Convex from side to side, concave from above downwards at upper part. Presents several arterial grooves and a foramen for a small vein.

Inner Surface – Inversely curved; presents a groove for external branch of nasal nerve.

Borders:

- Superior – Narrow, thick, articulates with frontal;
- Inferior – Broad, thin, joined to lateral cartilage of nose; has a notch for nasal nerve;
- External – Articulates with nasal process of superior maxillary bone;
- Internal – Thick, articulates with its fellow; is prolonged backwards into a crest which articulates with nasal spine of frontal & perpendicular plate of ethmoid.

LACHRYMAL BONES — Form front part of inner wall of orbit. Present:

Outer Surface – Presents from before backwards:

- *Groove*, which forms part of nasal duct;
- *Ridge*, which gives attachment to tensor tarsi muscle;
- *Smooth surface*, which forms part of inner wall of orbit.

Inner Surface – Presents a furrow corresponding to foregoing ridge; forms part in front of middle meatus, and articulates behind with ethmoid bone.

Borders:

- Anterior, Superior, Posterior – Articulate respectively with nasal & internal angular processes of superior maxillary & frontal bones, and with os planum of ethmoid.
- Inferior – Articulates behind with orbital plate of superior maxillary, and, in front, is prolonged downwards into a pointed process, *the hamulus lachrymalis*, which articulates with lachrymal process of inferior turbinated bone.

MALAR BONES — Articulate with temporal, frontal, sphenoid & superior maxillary bones, and form part of outer wall & floor of orbit, and of temporal & zygomatic fossæ. Present:

Outer Surface – Convex; presents a small malar foramen for malar branch of temporo-malar nerve, and gives attachment to the zygomatic muscles.

Inner Surface – Articulates internally with superior maxillary bone by a rough triangular surface, and is concave externally, where forms part of temporal & zygomatic fossæ and presents a foramen for temporal branch of temporo-malar nerve.

Orbital Process – Projects backwards forming part of outer wall & floor of orbit & of temporal fossa; articulates from above downwards with frontal, sphenoid & superior maxillary bones, and bounds spheno-maxillary fissure anteriorly. – On its inner surface it presents one or two temporo-malar foramina.

Frontal Process – Thick, vertical, articulates with external angular process of frontal.

Zygomatic Process – Long, horizontal, articulates with zygomatic process of temporal.

Borders:

- Antero-Superior – Forms lower & outer part of circumference of orbit.
- Antero-Inferior – Articulates with superior maxillary bone.
- Postero-Superior & Postero-Inferior – Are continuous with superior and inferior margins of zygomatic process.

INFERIOR TURBINATED BONES — Thin, and extend along whole length of outer wall of nasal fossa. Present:

Outer concave & **Inner** convex **Surfaces**, marked by vascular grooves and canals, and the latter of which looks upwards & inwards.

Upper Border – Which, from before backwards:

- Articulates with inferior turbinated crest of superior maxillary;
- Forms *lachrymal process*, which articulates with lachrymal & superior maxillary bones and completes nasal duct;
- Presents *maxillary process*, which curves downwards and outwards over lower edge of orifice of antrum of Highmore.
- Presents *ethmoidal process*, which ascends to join unciform process of ethmoid.

Lower Border – Is free and slightly thickened.

VOMER — Forms posterior part of nasal septum, and is frequently bent to one or other side. Presents:

Lateral Surfaces – Present vascular & nervous furrows, and naso-palatine groove for naso-palatine nerve.

Superior Border – Presents a deep groove bounded by two projecting *alæ*, between which the rostrum of the sphenoid is received, and which are overlapped inferiorly by the vaginal processes of the same bone.

Inferior Border – Articulates with ridge formed by palate plates of superior maxillary & palate bones.

Anterior Border – Is grooved above for articulation with perpendicular plate of ethmoid and joined below to cartilage of the septum.

Posterior Border – Free, thicker above than below; separates posterior apertures of of the nares

THE ORBIT.

Quadrilateral pyramidal fossa looking forwards & outwards and formed by seven bones, the frontal, ethmoid, sphenoid (which enter into formation of both orbits), superior maxillary, malar, lachrymal & palate.
Communicates with cranium, and with nasal, temporal, zygomatic & spheno-maxillary fossæ through optic foramen, nasal duct & spheno-maxillary fissure.
Presents:

ROOF — Formed by orbital plate of frontal & lesser wing of sphenoid. Is concave, and presents the suture between the foregoing bones, and in front the
Lachrymal fossa for lachrymal gland, and a
Depression (fovea trochlearis) for pulley of superior oblique.

FLOOR — Formed by upper or orbital surface of superior maxillary and orbital processes of malar & palate bones. Presents the sutures between foregoing bones, the
Infra-orbital groove for infra-orbital vessels & nerve, which becomes converted in front into
Infra-orbital canal; and also at its anterior & inner part a
Depression for inferior oblique muscle.

INNER WALL — Formed from before backwards by nasal process of superior maxillary, lachrymal, os planum of ethmoid, body of sphenoid. Is antero-posterior in direction and parallel to its fellow, and presents the sutures between foregoing bones and the
Lachrymal groove for lachrymal sac,
Crest of lachrymal bone for tensor tarsi muscle.

OUTER WALL — Formed in front by orbital process of malar bone, and behind by anterior or orbital surface of great wing of sphenoid. Is very oblique forwards & outwards being nearly at right angles with its fellow, and presents the suture between foregoing bones, and the
Orifices of one or two malar canals,
Small spine for lower head of external rectus.

ANGLES:

SUP. EXTERNAL – Presents:
Articulation of frontal with malar bone & orbital plate of sphenoid,
Sphenoidal fissure or *foramen lacerum anterius* for 3rd, 4th & 6th nerves and ophthalmic nerve & vein.

SUP. INTERNAL – Presents
Suture connecting frontal with lachrymal & os planum, in which suture are the
Anterior ethmoidal canal for nasal nerve & anterior ethmoidal vessels, and the
Posterior ethmoidal canal for posterior ethmoidal vessels.

INF. EXTERNAL – Presents
Spheno-maxillary fissure for infra-orbital vessels & nerve and ascending branches of Meckel's ganglion.

INF. INTERNAL – Presents
Articulation of superior maxillary & palate bones with lachrymal & os planum.

CIRCUMFERENCE OR BASE — Quadrilateral, looks forwards & outwards. Is bounded by supra-orbital arch and external & internal angular processes of frontal, anterior border of orbital surface & nasal process of superior maxillary, and anterior border of malar bone. Presents
Supra-orbital notch or foramen for supra-orbital vessels & nerve; and assists in forming
Lachrymal groove for lachrymal sac.

APEX — Corresponds to optic foramen for optic nerve & ophthalmic artery.

THE NASAL FOSSÆ.

Two narrow irregular cavities comprised between the orbits & superior maxillary bones, and between the roof of the mouth & the front part of the base of the skull.
Formed by ethmoid, sphenoid, frontal, superior maxillary, nasal, palate, inferior turbinated & vomer (all the bones of the face except malar & inferior maxillary).
Communicate with orbit (nasal duct), mouth, (anterior palatine canal), cranium (olfactory foramina), spheno-maxillary fossa (spheno-palatine foramen), and with the frontal, ethmoidal, sphenoidal, & maxillary sinuses. – Present:

ROOF — Narrow, and is from before backwards:
Oblique upwards & backwards and formed by nasal bone & nasal spine of frontal,
Horizontal and formed by cribriform plate of ethmoid,
Oblique downwards & backwards and formed by body of sphenoid. – Presents the sutures between the foregoing bones and from before backwards:
Groove on nasal bone for outer branch of nasal nerve;
Half crest for perpendicular plate of ethmoid;
Olfactory foramina & *nasal slit* for olfactory and nasal nerves;
Openings of sphenoidal sinuses partly closed by sphenoidal turbinated bones;
Articulation of alæ of vomer with body of sphenoid.

FLOOR — Concave from side to side, and formed by palate processes of superior maxillary & palate bones. – Presents the suture between foregoing bones & the
Upper orifice of the anterior palatine canal;
Half crest for vomer, which terminates in front & behind in the
Anterior & posterior nasal spines.

INNER WALL — Formed principally by the perpendicular plate of the ethmoid above & in front, and by the vomer below & behind, and secondarily by nasal spine of the frontal, rostrum of sphenoid, crests of superior maxillary, nasal & palate bones. Has an angular deficiency in front which is filled up by the cartilage of the septum. – Is frequently inclined to one or other side; and presents the sutures between the foregoing bones and
Vascular & nervous furrows &
Naso-palatine groove for naso-palatine nerve.

OUTER WALL — Formed by:
Lachrymal bone & nasal process of superior maxillary;
Inner surface of ethmoid, superior maxillary & inferior turbinated bones;
Vertical plate of palate bone & inner plate of pterygoid process. – Presents the sutures between the foregoing bones and from above downwards:
Superior turbinated process of ethmoid;
Superior meatus, into which open the sphenoidal & posterior ethmoidal sinuses and the spheno-palatine foramen. – Both are short and are situated at the posterior and upper part of the nares;
Middle turbinated process of ethmoid;
Middle meatus, larger than foregoing, into which open the Antrum of Highmore and through the infundibulum, the anterior ethmoidal cells & frontal sinuses;
Inferior turbinated bone;
Inferior meatus, the largest, presents in front the opening of the nasal duct.

LATERAL REGION of the SKULL

Presents from behind forwards the:

Mastoid process;
Ext. auditory meatus;
Zygomatic arch & *ramus of the jaw*, which two latter arch over the temporal, zygomatic & spheno-maxillary fossæ.

TEMPORAL FOSSA

Is formed by the temporal, frontal, & malar bones, the great wing of the sphenoid, & the anterior inferior angle of the parietal, and is deeply excavated below & in front.

Is bounded above by the temporal ridge, and opens widely below into the zygomatic fossa, the boundary line between the two being the zygomatic arch & the pterygoid ridge.

ZYGOMATIC FOSSA

Is an irregular and imperfectly enclosed space, the incomplete walls of which are formed on the anterior, inner, upper & outer aspects respectively by the

Tuberosity of the sup. maxillary bone,
Ext. pterygoid plate,
Under surface of great wing of sphenoid as far as pterygoid ridge, and *squamous portion of temporal bone.*
Zygomatic arch & *ramus of lower jaw.*

Communicates with temporal fossa beneath the zygoma, and with the orbit & spheno-maxillary fossæ through the spheno-maxillary & pterygo-maxillary fissures.

Spheno-Maxillary Fissure – Is bounded by superior maxillary, great wing of sphenoid, malar & palate bones, and joins internally at right angles with pterygo-maxillary fissure.

Opens up communications between the orbit and the temporal, zygomatic & spheno-maxillary fossæ.

Transmits infraorbital artery, superior maxillary nerve & ascending or orbital branches of Meckel's ganglion.

Pterygo-Maxillary Fissure – Is comprised between pterygoid process & tuberosity of superior maxillary bone.

Joins superiorly at right angles with spheno-maxillary fissure.

Transmits internal maxillary artery from zygomatic to spheno-maxillary fossa.

SPHENO-MAXILLARY FOSSA — Is the narrow & vertically elongated space comprised between the pterygoid process & the maxillary tuberosity, and bounded above & internally by the body of the sphenoid & the vertical plate of the palate bone.

Its upper part is the point of meeting of the sphenoidal, spheno-maxillary & pterygo-maxillary fissures.

It communicates with the cranium, orbit, zygomatic & nasal fossæ by the foramen rotundum & spheno- & pterygo-maxillary fissures & the spheno-palatine foramen, and has, opening into it, the vidian, pterygo-palatine, posterior palatine & accessory posterior palatine canals.

UNDER SURFACE of the BASE of the SKULL

Is bounded from before backwards by:
Alveolar arch & teeth of upper jaw;
Lower border of malar bone, zygoma & imaginary line from zygoma to mastoid process;
Superior curved line of occipital bone.

Grouping points of interest on under surface of skull, the latter may be said to present from before backwards:
Roof of Mouth;
Posterior Aperture of Nares:
Under Surface of Basilar Process, on each side of which is a
Quadrilateral Space, the angles of which are formed by the Condyle of the occipital bone, and by the Pterygoid, Zygomatic and Mastoid Processes. This space is the Author's CONDYLO-PTERYGO-ZYGOMATO-MASTOID SPACE.
Under Surface of Remaining Part of Occipital Bone.

ROOF OF THE MOUTH

Is formed by palate processes of superior maxillary & horizontal plates of palate bones, and is bounded laterally & in front by alveolar arch

Is concave, uneven & marked by a crucial suture, and presents from before backwards & outwards
Lower opening of anterior palatine canal, into which may be seen to open, laterally
  Foramen of Stenson for anterior palatine vessels, and in middle line,
  Foramina of Scarpa for naso-palatine nerves;
A groove leading to
  Posterior palatine foramen for post. palatine vessels & ant. or great palatine n.
Transverse ridge for attachment of aponeurosis of tensor palati;
Accessory or small palatine foramina, posterior & external, for posterior or small, and th external palatine nerves

POSTERIOR APERTURE OF THE NARES

Is bounded by body of sphenoid, horizontal plate of palate bone, and inner plates of pterygoi processes, which latter present inferiorl
Hamular process for reflection of tendon of tensor palati, and superiorly,
Scaphoid fossa for origin of that muscle.

Is divided into two by vomer, and presents inferiorly
Posterior nasal spine for origin of azygos uvulæ, and superiorly
Expanded alæ of vomer, which articulate with rostrum & with vaginal processes sphenoid, and on either side of which a
  Pterygo-palatine canals formed in part by sphenoid & in part by palate bone and giving passage to pterygo-palatine vessels & nerve

UNDER SURFACE OF THE BASILAR PROCESS

Presents in middle line
Pharyngeal spine for median raphe & superior constrictor of pharynx, and laterally,
Rough depressions for insertion of recti capitis antici major & minor.

CONDYLO-PTERYGO-ZYGOMATO-MASTOID SPACE —V. next Table

UNDER SURFACE OF THE OCCIPITAL BONE (Remaining Part)—Pr sent

Foramen magnum for cord & its membranes, vertebral arteries & spinal accesso nerves, on outer side of which foramen a
  Condyles of occipital bone having
    Jugular process on their outer side,
    Anterior condyloid foramen in front,
    Posterior condyloid fossa sometimes perforated by the *posterior condyl foramen* behin
Ext. Occipital Crest giving off laterally
Superior & Inferior curved lines, and ending posteriorly in
External occipital protuberance,
  For parts just mentioned see Occipital Bone.

CONDYLO-PTERYGO-ZYGOMATO-MASTOID SPACE

Is formed by the under surfaces of the occipital bone and of the squamous & petrous portions of the temporal and of the greater wing of the sphenoid, and is situated on either side of the basilar process.

It is quadrangular.

ITS ANGLES

Are formed by the Condyles of the occipital bone and by the Pterygoid, Zygomatic & Mastoid processes. (Vide these parts in respective Tablets.)

It is divided in two by a well marked diagonal line obliquely directed from before backwards & outwards, and presents points of interest both in front of & behind its diagonal line.

ITS DIAGONAL LINE

Extends from the root of the pterygoid to the mastoid process, and presents from before backwards & outwards the

Foramen lacerum medium closed by cartilage, and crossed superiorly by the internal carotid artery & the Vidian nerve;

Rough surface for origin of levator palati & tensor tympani;
Inf. orifice of Carotid Canal;
Vaginal process;
Styloid process, which gives attachment to the stylo-hyoid & -maxillary ligaments and from above downwards to the stylo-pharyngeus, -hyoideus & -glossus muscles:
Stylo-mastoid foramen for facial nerve & stylo-mastoid artery.

IN FRONT & on the OUTER SIDE of the DIAGONAL LINE

Are found from before backwards & outwards the
- *Foramen ovale* for inferior maxillary & small petrosal nerves and small meningeal artery, and on inner side of which is sometimes found the
  - *Foramen Vesalii* for a small vein;
- *Foramen Spinosum* for middle meningeal artery;
- *Spine of the Sphenoid* for internal lateral ligament of jaw & laxator tympani m.
- *Openings of the canal for the tensor tympani muscle (above) & of the osseous portion of the Eustachian tube (below).*
- *Glenoid fossa* divided by Glaserian fissure into
  - *Anterior part*, covered with cartilage which latter is prolonged over the emimentia articularis;
  - *Posterior part* non articular, and bounded behind by the vaginal & auditory processes and the middle root of the zygoma.

BEHIND & on the INNER SIDE of the DIAGONAL LINE

Are the:
- *Jugular fossa* for internal jugular vein. This fossa assists in forming the
- *Jugular foramen or Foramen Lacerum posterius*, of which the
  - *Anterior or inner part*, smaller and separated from the remainder by a bony ridge, gives passage to the glosso-pharyngeal, pneumogastric & spinal accessory nerves, while the
  - *Posterior part*, the larger, transmits the internal jugular vein;
- *Jugular process* for rectus capitis lateralis & lateral occipito-atloid ligament. This process has in front of it & to its inner side the
- *Anterior condyloid foramen* for hypoglossal nerve; behind it & to its inner side the
- *Posterior condyloid fossa* sometimes perforated by *posterior condyloid foramen* for a small vein to lateral sinus.
- *Openings for Jacobson's & Arnold's nerves, and opening of Aqueductus Cochleæ.*

THE SCAPULA—1st Tablet.

Large, flat, triangular, situated at back of shoulder, and presents two surfaces, three borders, three angles.

ANTERIOR SURFACE or VENTER — Concave; forms subscapular fossa, which fossa is deepest at upper & outer part, and presents from within outwards:

narrow marginal surface for serratus magnus, which surface becomes broader & triangular opposite the superior & inferior angles;

rough oblique ridges converging upwards & outwards for tendinous intersections of subscapularis;

rounded prominent ridge descending from neck of scapula;

deep vertical groove for lower part of subscapularis.

POSTERIOR SURFACE or DORSUM — Divided by spine into:

Supraspinous Fossa – The smaller, smooth, broadest internally, for supraspinatus.

Infraspinous Fossa – The larger, slightly convex towards middle, concave on either side. Presents internally a few *oblique ridges* for tendinous intersections of infraspinatus, and externally a rough aponeurotic *ridge*, which cuts off a *prominent marginal surface* divided in two by an oblique line & crossed by a groove for dorsalis scapulæ artery, which surface gives origin in its narrow upper two-thirds, to the teres minor, and in its lower & broader third, to the teres major & occcasionally to some of the fibres of the latissimus dorsi.

The Spine – Is a prominent triangular plate, which crosses obliquely the dorsum of the scapula towards its upper part, and which is continued into the acromion. It presents:

Surfaces:

Upper & Lower – Concave, forming part respectively of the supra- & infraspinous fossæ.

Borders:

Anterior – Continuous with the remainder of the bone.

Posterior – Broad & thick. Commences internally by a triangular smooth surface covered by tendon of insertion of trapezius; gives attachment externally to this surface, to trapezius by its upper lip, to deltoid by its lower lip.

External – Concave, rounded; lost above upon under surface of acromion, below upon neck of scapula.

Acromion Process – Overhangs glenoid cavity, and is flattened & somewhat triangular. It presents:

Surfaces:

Superior – Rough for attachment of deltoid & trapezius.

Inferior – Concave & smooth, separated by a bursa from capsule of shoulder joint.

Borders:

Outer & Inner – For deltoid & trapezius, the latter presenting a small oval facet for clavicle.

Apex – Gives attachment to the coraco-acromial ligament.

THE SCAPULA—2nd Tablet.

BORDERS — Three:

Superior - The shortest & thinnest. Presents externally the
suprascapular notch converted by the transverse ligament into a foramen for suprascapular nerve; - and gives origin just internally to the notch to the omo-hyoid muscle.

External or Axillary - The thickest. Presents just below glenoid cavity a
rough depression for long head of triceps, and below this the
vertical groove above mentioned for lower part of subscapularis.

Internal or Vertebral, or Base - The longest, thin, prominent opposite root of spine. Presents:
anterior lip for serratus magnus;
posterior lip for supra- & infraspinati;
interspace for levator anguli scapulæ, rhomboideus minor, and aponeurosis & fibrous arch of rhomboideus major.

ANGLES — Three:

Superior - Thin, prominent, for a few fibres of the levator anguli scapulæ & supraspinatus, and the two first digitations of the serratus magnus.

Inferior - Thick, rounded; gives attachment posteriorly to the teres major & occasionally to some of the fibres of the latissimus dorsi, and anteriorly to the four lower digitations of the serratus magnus.

Anterior or External - Forms the head & the neck of the scapula.

HEAD — Presents the

Glenoid Cavity - Oval with longest diameter vertical, and with broad inferior & narrow superior extremities, the latter giving attachment to the tendon of the long head of the biceps; small & shallow, but slightly deepened & enlarged by glenoid ligament, which ligament is attached to the prominent margin of the cavity.

NECK — Flattened from before backwards, and most distinct behind. Is surmounted by the

Coracoid Process - First thick & broad, and passes upwards & inwards, being flattened from before backwards, and presenting internally a rough depression for conoid ligament. It then becomes smaller, passes forwards & outwards, and is flattened from above downwards; this terminal portion presents:
under surface, smooth & concave;
upper surface with rough oblique ridge for trapezoid ligament;
anterior or inner border for pectoralis minor;
posterior border for coraco-acromial ligament;
apex for common tendon of coraco-brachialis & of short head of biceps.

THE CLAVICLE

Is usually reckoned as a long bone, though, structurally, it rather resembles a short bone. It is curved like an italic *ƒ* and is convex anteriorly & rounded in its inner two-thirds, concave anteriorly and flattened from above downwards, in its outer third.

INNER or CYLINDRICAL PORTION — Presents three borders and three surfaces.

Borders – Are:

Anterior – Continuous with anterior border of flattened portion, and gives attachment to pectoralis major.

Posterior – Extends from rhomboid impression to conoid tubercle, and forms posterior boundary of subclavian groove.

Superior – Continuous with posterior border of flattened portion, and gives attachment to sterno-mastoid.

Surfaces – Are:

Anterior – Convex & continuous with upper surface of flattened portion. Is covered externally by platysma, and gives attachment internally to sterno-mastoid & pectoralis major.

Posterior – Concave, narrow externally, where it becomes continuous with posterior border of flattened portion. Frequently gives origin internally to some of the fibres of the sterno-cleido-hyoid, and presents towards its middle the nutrient canal, which is directed outwards.

Inferior – Narrow internally; broader externally, where it becomes continuous with under surface of flattened portion. Presents from within outwards:

Articular facet, which articulates with cartilage of first rib, and which is continuous with sternal articular surface;

Rhomboid impression for rhomboid or costo-clavicular ligament;

Subclavian groove for subclavius muscle.

OUTER or FLATTENED PORTION — Presents:

Borders:

Anterior – Thin, concave, for deltoid.

Posterior – Thicker, convex, for trapezius.

Surfaces:

Superior – Rough, for deltoid & trapezius.

Inferior – Presents internally

Conoid tubercle for conoid ligament, from which tubercle passes forwards & outwards the

Oblique line for trapezoid ligament.

INNER or STERNAL END — Enlarged & triangular. Its articular facet is continuou with the costal facet at inner extremity of inferior surface. It is concav from before backwards and convex from above downwards & outwards; i gives attachment at its upper & back part to the interarticular fibro-cartilag of the sterno-clavicular articulation. – The circumference of the end of th bone is rough for the anterior & posterior sterno-clavicular & the interclavicular ligaments

OUTER or ACROMIAL END — Flattened from above downwards. Presents a sma oval facet, which looks downwards & outwards and articulates with acromio – The circumference of the end of the bone is rough for the superior inferior acromio-clavicular ligament

THE HUMERUS

Presents upper & lower extremities and a shaft.

UPPER EXTREMITY

UPPER EXTREMITY — Presents head, anatomical & surgical necks, greater & lesser tuberosities, and bicipital groove.

Head – Represents nearly one half of a sphere, and is much more extensive than the glenoid cavity, or corresponding articular surface of the scapula. It looks upwards, inwards & backwards, and is bounded by the

Anatomical Neck – A slight circular constriction, rather irregular, which gives attachment to the capsule of the shoulder-joint.

Greater Tuberosity – Large rounded eminence situated on the outer side of the bicipital groove. It presents from before backwards three small facets for supra- & infra-spinati & teres minor.

Lesser Tuberosity – Smaller, but more prominent, situated in front of the head, on the inner side of the bicipital groove. It gives attachment to the subscapularis.

Bicipital Groove – Corresponds to the upper third of the bone. It is deep & narrow above, where it separates the tuberosities, but it becomes broad & shallow below, where the tendon of the latissimus dorsi is inserted into it. It contains the long tendon of the biceps surrounded by a tubular prolongation of the synovial membrane of the shoulder-joint, and is covered with a thin layer of cartilage. Its anterior or outer lip gives attachment to the pectoralis major, its posterior or inner lip, to the teres major.

Surgical Neck – Is the slightly constricted part which joins upper extremity to shaft.

LOWER EXTREMITY

LOWER EXTREMITY — Is flattened from before backwards & slightly curved forwards. It presents an articular surface, and the inner and outer condyles.

Articular Surface

Articular Surface – Extends a little lower than the condyles, and occupies a more anterior position. It is divided into:

Radial Portion, Head, or Capitellum – Small rounded eminence limited to the front part of the bone. It is separated from the trochlear portion by a narrow groove for inner border of head of radius, and is surmounted by a slight depression which receives the anterior border of the same head when the fore-arm is completely flexed.

Ulnar or Trochlear Portion – Extends also to the back of the bone. The inner border of the trochlea descends lower down than the outer one; the axis round which the ulna rotates is therefore directed downwards & inwards, and the plane of rotation downwards & outwards. – The trochlea is surmounted in front & behind by the coronoid & olecranon fossæ, which receive the corresponding processes in complete flexion, or complete extension, of the fore-arm. These fossæ are lined by the synovial membrane, and are separated by only a thin plate of bone; their margins give attachment to the anterior & posterior ligaments of the elbow-joint.

Inner Condyle

Inner Condyle – The most prominent & the highest. Gives attachment to the internal lateral ligament of the elbow-joint, & to the pronator radii teres, flexor carpi radialis, palmaris longus, flexor carpi ulnaris & flexor sublimis digitorum muscles.

External Condyle

External Condyle – The lowest & least prominent. Gives attachment to the external lateral ligament of the elbow-joint & to the extensores carpi radialis brevior, communis digitorum, minimi digiti & carpi ulnaris, and to the anconeus & supinator brevis muscles.

SHAFT

SHAFT — Cylindrical above; prismatic and flattened from before backwards, below. Presents three borders & three surfaces.

Borders

Borders – Are:

Anterior – From front of great tuberosity to coronoid depression, forming, above, anterior or outer lip of bicipital groove for attachment of pectoralis major.

Internal – From lesser tuberosity to internal condyle, forming, above, inner or posterior lip of bicipital groove for attachment of teres major, and, below, internal condyloid ridge for internal intermuscular septum, pronator radii teres, inner head of triceps & brachialis anticus. Towards its middle is found the opening of the nutrient canal directed downwards.

External – From back of greater tuberosity to external condyle. Is indistinct and crossed by musculo-spiral groove, above; inferiorly it becomes prominent, and forms the external condyloid ridge for external intermuscular septum, supinator longus, extensor carpi radialis longior, outer head of triceps & brachialis ant.

Surfaces

Surfaces – Are internal, external, & posterior; the two former becoming more or less anterior below, where all three are broader & better defined than above.

Internal – Rather narrower than external. Presents towards its middle a rough impression for coraco-brachialis, and frequently towards its lower part, the supra-condyloid process of Struthers.

External – Rather broader. Presents towards its middle a rough triangular impression for deltoid, and gives attachment below to brachialis anticus.

Posterior – Somewhat twisted. Is crossed obliquely downwards & outwards by musculo-spiral groove, and gives origin, above & below the groove, to the outer & inner heads of the triceps.

THE RADIUS

Is smaller & shorter than than the ulna, and is smaller above than below. **Presents:**

UPPER EXTREMITY — The smaller. Presents:

Head – Cylindrical laterally and cup-shaped above. The cup articulates with the capitellum of the humerus, and its inner & broader edge articulates with the groove between the capitellum & the trochlea. The inner & broader part of the cylindrical surface articulates with the lesser sigmoid cavity of the ulna, the outer narrower part plays upon the orbicular ligament.

Neck – Is the constricted & rounded portion, which supports the head. It presents posteriorly a slight ridge for supinator brevis.

Tuberosity – Lies at the lower, inner & front part of the neck. It is rough behind for insertion of biceps, and smooth in front, where it is covered by a bursa.

LOWER EXTREMITY — Large, thick, quadrilateral, and presents an inferior surface, articular, and four lateral surfaces, of which the inner one is also articular.

Inf. Articular Surface – Triangular, concave, divided by a slight antero-posterior ridge into an outer, larger, triangular portion for scaphoid, and an inner, smaller, quadrilateral portion for semilunar.

Int. Articular Surface, or Sigmoid Cavity – Narrow, concave, articulates with head of ulna.

Ant. Surface – Excavated; gives attachment to pronator quadratus. Its lower prominent margin gives attachment to anterior ligament of wrist-joint.

Ext. Surface – Is prolonged downwards into the

Styloid Process – Thick & conical; gives attachment at its base to supinator longus, at its apex, to external lateral ligament of wrist-joint. On its oute surface is a

shallow groove, oblique downwards & forwards and divided into two by a slight ridge, which groove transmits the extensores ossis metacarpi & primi internodii pollicis, both of which are enclosed i one synovial sheath

Post. Surface – Convex, gives attachment below to posterior ligament of wrist-joint, an presents from without inwards

broad & shallow groove divided into two by a slight ridge, which groov transmits the extensores carpi radialis longior & brevior, bot enclosed in one synovial sheath

narrow & deep groove for extensor secundi internodii pollicis & a synovia sheath

broad & shallow groove for extensores indicis & communis digitorum bot enclosed in one synovial sheath

half-groove completed internally by head of ulna, for extensor minimi digi & a synovial sheat

SHAFT — Slightly concave anteriorly, small & rounded above, larger & prismoid below. Presents

Borders – Three:

Anterior – From front of bicipital tuberosity to front of base of styloid process. I prominent above, where it forms the *oblique line,* and gives attachment to th supinator brevis, flexor sublimis digitorum & flexor longus pollicis; is sharpl marked below for pronator quadratu

Posterior – From back of neck to back of styloid process; is most distinct in i middle thir

Internal – From back of tuberosity to sigmoid cavity, to embrace which it bifurcat inferiorly. Gives attachment to the interosseous ligament, and is sharpe towards its middl

Surfaces – Three:

Anterior – Narrow & concave in upper three-fourths for flexor longus pollicis, broa & concave in lower fourth for pronator quadratus. Presents nutrient forame a little above its middl

Posterior – Narrow & rounded above for supinator brevis; broad & convex belo Gives origin towards its middle, where it is rough & slightly concave, to exte sor primi internodii pollicis & to some of the fibres of the extensor ossis met car

External – Rounded & convex. Gives attachment above to supinator brevis a presents towards its middle a rough impression for pronator radii teres.

THE ULNA

Is larger & longer than the radius, and larger above than below. Presents:

UPPER EXTREMITY

— The strongest part of the bone; presents the coronoid & olecranon processes, and the greater & lesser sigmoid cavities.

Coronoid Process

– Prismatic. Projects forwards, and presents:

Apex – Slightly curved upwards; received into coronoid fossa in complete flexion of fore-arm;
Base – Broad, continuous with shaft;
Upper Surface – Articular, concave from before backwards, marked by a slight antero-posterior ridge.
Under Surface – Concave, rough for brachialis anticus & oblique ligament;
Inner Surface – Rough, concave behind for flexor profundus digitorum. Presents anteriorly & from above downwards:
prominent margin for internal lateral ligament of elbow-joint;
tubercle for middle head of flexor sublimis;
ridge for inner head of pronator radii teres. – A slip of the flexor longus pollicis arises sometimes from this surface.
Outer Surface – Presents lesser sigmoid cavity above, and gives origin below to some of the fibres of the supinator brevis.

Olecranon Process

– Large, slightly curved forwards. Presents:

Apex – Prominent, received into olecranon fossa in complete extension of forearm;
Base – Contracted, continuous with shaft;
Anterior Surface – Articular, concave, marked by a slight vertical ridge;
Posterior Surface – Triangular, subcutaneous, covered by a bursa;
Upper Surface – Rough behind for triceps; slightly grooved in front, close to margin, for posterior ligament of elbow-joint;
Borders, Inner & Outer – Presenting continuation of same groove for internal & posterior ligaments.

Greater Sigmoid Cavity

– Comprised between coronoid & olecranon processes, notched on either side towards its middle, and divided by a slightly elevated ridge into two parts, of which the internal is the broadest.

Lesser Sigmoid Cavity

– Situated on outer side of coronoid process, narrow, concave from before backwards; its extremities give attachment to the orbicular ligament of the radius.

LOWER EXTREMITY

— Small, excluded from wrist-joint by triangular fibro-cartilage. Presents:

Head – Articular below, where it is flattened and plays upon triangular fibro-cartilage, and externally, where it is semi-cylindrical and is received into lesser sigmoid cavity of radius.
Styloid Process – Cylindrical, descends from inner & back part of head; gives attachment to internal lateral ligament of wrist-joint. – Between these parts there exists below, a
Depression – For attachment of triangular fibro-cartilage, and behind, a
Groove – Which transmits tendon of extensor carpi ulnaris.

SHAFT

— Large & prismatic above, smaller & rounded below, slightly curved forwards, and convex externally above, internally below. Presents:

Borders

– Anterior, posterior, external, best marked in upper two-thirds.

Anterior – From ridge on inner surface of coronoid process to front of styloid process. Gives attachment to flexor profundus digitorum & pronator quadratus.
Posterior – From lower & back part of olecranon to back of styloid process. Gives attachment superiorly to an aponeurosis common to flexor & extensor carpi ulnaris and flexor profundus digitorum.
External – Bifid superiorly, where it arises from either extremity of the lesser sigmoid cavity, and embraces a rough surface for supinator brevis; is very prominent towards middle; gives attachment to interosseous ligament.

Surfaces

– Anterior, posterior, internal, all three broader above than below.

Anterior – Concave in upper three-fourths for flexor profundus digitorum, also excavated below for pronator quadratus. Presents the opening of the nutrient canal, which is directed upwards.
Posterior – Presents above a triangular surface for anconeus, which surface is bounded externally by an oblique ridge for supinator brevis. Below this the posterior surface is divided by a vertical ridge into a narrow inner part, which gives attachment to, or is sometimes merely covered by, the extensor carpi ulnaris, and an outer broader part which gives attachment from above downwards to the supinator brevis and extensores ossis metacarpi pollicis, secundi internodii pollicis, & indicis.
Internal – Gives attachment to the flexor profundus digitorum in its upper three-fourths; is subcutaneous in its lower fourth.

BONES of the CARPUS—First Row.

SCAPHOID — Presents:

Ant. or Palmar Surface – Concave above; presents at its lower & outer part a tubercle for anterior annular ligament of carpus.

Post. or Dorsal Surface – Is represented by a rough transverse groove for ligaments.

Upper Surface – Is very oblique, and looks backwards & but slightly upwards; is convex & smooth, and articulates with radius.

Under Surface – Looks principally downwards, but also a little backwards & outwards. It presents two facets for trapezium & trapezoid.

Outer Surface or Angle – Small, rough, for external lateral ligament of wrist.

Inner Surface – Presents a superior small semilunar facet for semilunar, and an inferior large concave facet for os magnum.

SEMILUNAR — Presents:

Ant. & Post. Surfaces – Of which the former is the largest.

Upper Surface – Convex; articulates with radius.

Under Surface – Concave; articulates with os magnum & os unciform.

Outer Surface – Has a semilunar facet for scaphoid.

Inner Surface – Has a quadrilateral facet for cuneiform.

CUNEIFORM — Presents:

Ant. & Post. Surfaces – Of which the former is the smallest, and presents at its inner part an oval facet for pisiform

Upper Surface – Smooth in its outer part only, where it articulates with the triangula fibro-cartilage of the inferior radio-ulnar articulation

Under Surface – Concave externally, convex internally; articulates with inner surface o unciform bone

Outer Surface – Has a quadrilateral facet for semilunar.

Inner Surface or Angle – Small, rough, for internal lateral ligament of wrist.

PISIFORM — Presents:

Ant. Surface – Convex, for anterior annular ligament of carpus.

Post. Surface – At upper part of which is an oval articular facet for cuneiform.

Outer Surface – Convex.

Inner Surface – Concave.

BONES of the CARPUS — Second Row.

TRAPEZIUM — Presents:

Ant. Inner or Palmar Surface – Has a vertical groove for tendon of flexor carpi radialis, which groove is bounded externally by an oblique ridge for attachment of anterior annular ligament of carpus & abductor pollicis.

Post. outer or Dorsal Surface – Large & rough.

Upper Surface – Small, concave; articulates with scaphoid.

Under Surface – Convex from side to side and concave from before backwards (the bone being placed in its normal position, that is to say with its palmar surface looking almost directly inwards and nearly facing the unciform process of the unciform bone); articulates with the metacarpal bone of the thumb.

Outer Surface – Broad & rough.

Inner Surface – Has a large superior concave articular surface for trapezoid, and a small narrow inferior facet for 2nd metacarpal bone.

TRAPEZOID — Presents:

Ant. & Post. Surfaces – Rough, the latter of which is the largest and is prolonged downwards & inwards.

Upper Surface – Quadrilateral, concave, for scaphoid.

Under Surface – Saddle shaped for articulation with base of 2nd metacarpal bone.

Outer Surface – Convex, smooth; articulates with trapezium.

Inner Surface – Concave & smooth below and in front for articulation with lower part of os magnum; rough above and behind for an interosseous ligament.

OS MAGNUM — May be divided into head, neck, & body. Presents:

Ant. & Post. Surfaces – Rough, the latter of which is the largest, and is prolonged downwards & inwards.

Upper Surface – Rounded & smooth for semilunar.

Under Surface – Projects inwards in its posterior part, and has three facets (the middle one of which is the largest), for articulation with 2nd, 3rd & 4th metacarpal bones.

Outer Surface – Presents from above downwards: a smooth convex surface for scaphoid, a rough groove which forms part of the neck, a small facet for trapezoid at anterior inferior angle, behind which latter is a depression for an interosseous ligament.

Inner Surface – Smooth behind for unciform bone, rough in front for an interosseous ligament.

UNCIFORM BONE — Presents:

Ant. or Palmar Surface – Presents the unciform process at its lower & inner part. This process projects directly forwards when the bone is placed in its normal position, and presents outer concave & inner convex surfaces, and an apex, which latter gives attachment to the anterior annular ligament of the carpus and to the flexor brevis & adductor or opponens minimi digiti.

Post. or Dorsal Surface – Rough & triangular.

Upper Surface or Angle – Narrow, smooth, articulates with semilunar.

Under Surface – Has two facets for 4th & 5th metacarpal bones.

Outer Surface – Smooth above & behind for os magnum, rough below and in front for an interosseous ligament.

Inner Surface – Smooth, convex above, concave below, articulates with cuneiform.

How to Class Shattered Bones of the Carpus into Right & Left.

It is easy to recognise whether a bone of the carpus belongs to the right or to the left side when it is placed in position as follows:

Scaphoid -	Largest articular facet above; Rough transverse groove behind; Tubercle on outer side.
Semilunar -	Convex articular facet above; Largest rough surface in front; Semilunar articular facet on outer side.
Cuneiform -	Convex surface partly articular & partly non-articular, above; Flat surface partly articular partly non-articular in front; Small surface or angle on inner side.
Pisiform -	Articular facet behind; Non-articular part of same surface below, Concave surface on inner side.
Trapezium -	Saddle-shaped articular facet below; Ridge in front; Rough lateral surface on outer side.
Trapezoid -	Saddle-shaped articular facet below; Large rough surface behind; Its projecting part on inner side.
Os Magnum -	Head above; Large rough surface behind; Projecting part of the same (or tubercle of the base) on inner side.
Os Unciform -	Unciform process below & in front; Its concavity to outer side.

THE METACARPAL BONES

Long bones with shaft & two extremities.

COMMON CHARACTERS:

Shaft – Prismoid & concave anteriorly. Presents:
DORSAL SURFACE – Triangular, broad below, covered by extensor tendons.
LATERAL SURFACES – Concave, divided by a ridge into two parts for palmar & dorsal interossei. The ridge bifurcates below, and its branches end in the tubercles on either side of head.

Carpal Extremity or Base – Cuboid. Presents:
PALMAR & DORSAL SURFACES – Rough for ligaments; the latter is the largest.
SUP. & LATERAL SURFACES – Articular, for carpus & adjoining metacarpal bones.

Digital Extremity or Head – Presents:
INF. OR ARTICULAR SURFACE – Rounded, extending farther in front than behind, and slightly flattened from side to side.
LATERAL SURFACES – Depressed; present two tubercles, of which posterior one is for lateral ligt. of corresponding metacarpo-phalangeal articulation.
ANT. SURFACE – Grooved for flexor tendons.
POST. SURFACE – Broad & flat.

PARTICULAR CHARACTERS:

METACARPAL B. OF THUMB — The shortest.

SHAFT – Thick & broad; its palmar surface looks inwards.
CARPAL EXTREMITY – Saddle-shaped for trapezium (convex from before backwards, concave from side to side) & broadest externally; no lateral facets.
DIGITAL EXTREMITY.– Broader & less convex anteriorly than in the other metacarpal bones; presents two small lateral facets for sesamoid bones.

METACARPAL B. OF INDEX — The longest.

CARPAL EXTREMITY – Larger than in the others, and presents posteriorly a prolongation upwards & inwards towards os magnum. Has four articular surfaces, one saddle-shaped above for trapezoid, and three others for trapezium, os magnum & 3rd metacarpal bone.

METACARPAL B. OF MIDDLE FINGER — The longest but one.

CARPAL EXTREMITY – Presents a prolongation upwards & outwards behind os magnum, and has four articular facets, one for os magnum, one for 2nd metacarpal bone, and two for 4th.

METACARPAL B. OF RING FINGER — Short.

CARPAL EXTREMITY – Pretty regularly cuboid. Presents five facets for unciform, os magnum, 3rd (two facets), & 5th metacarpal bones.

METACARPAL B. OF LITTLE FINGER — The smallest & the shortest but one.

CARPAL EXTREMITY – Has a prominent tubercle on inner side for extensor carpi ulnaris; carpal facet is saddle-shaped for unciform; only one lateral facet for 4th metacarpal bone.

N.B.—The foregoing characters supply the three points requisite to place the bones in position, and therefore to distinguish between right bones and left bones.

THE PHALANGES.

Fourteen, three to each finger, two to thumb. Are long bones and present:

Shaft – Slightly curved anteriorly. Flat from side to side on palmar surface, convex on dorsal. Margins prominent for attachment of sheaths of flexor tendons. – The shaft is longer in first or proximal phalanges than in second, in second than in third.

Proximal Extremity – The largest. Presents:
IN FIRST ROW – Oval, concave, articular surface, broadest from side to side.
IN SECOND & THIRD ROWS – Two lateral concavities & a median ridge.

Distal Extremity – The smallest. Presents:
IN FIRST & SECOND ROWS – A trochlear surface prolonged farther in front than behind.
IN THIRD ROW – A rough horse-shoe shaped eminence on palmar surface.

THE INNOMINATE BONE—1st Tablet.

Large irregular flat bone, constricted towards its middle, and expanded above & below; so twisted upon itself that its superior expansion is directed inwards posteriorly & outwards anteriorly, while its inferior expansion is curved inwards in front as far as the middle line.

Consists up to the 13th or 14th year of three distinct portions, the ilium, ischium & pubes, which portions, though they subsequently unite, are usually described separately

ILIUM — The superior expanded portion. Presents:

Outer Surface, or Dorsum – Convex in front, where it looks downwards & outwards, concave behind, where it looks downwards, outwards & backwards. Presents the

Three Curved Lines, superior, middle, & inferior, which commence respectively two inches in front of the posterior extremity of the crest, an inch & a half behind its anterior extremity, & at the upper part of the anterior inferior spinous process, and which converge, the two first towards the upper part, & the third towards the middle of the great sacro-sciatic notch.

Above, and between these lines are seen the

Surfaces of origin of the glutei maximus, medius & minimus;

Groove (sometimes a ridge), for reflected tendon of rectus. – Below this are the

Upper part of rim of acetabulum;

Triangular segment of the acetabulum forming nearly 2-5ths of that cavity, which 2-5ths include the greater part of the articular surface.

Inner Surface – Presents in front, behind, & below respectively:

INTERNAL ILIAC FOSSA OR VENTER – Bounded below by the ilio-pectineal line, and presenting inferiorly a nutrient foramen.

SACRO-ILIAC ARTICULAR SURFACE – Which is divided into an

Inferior or Auricular Portion – Covered with cartilage, smooth though uneven, and a

Superior Rough Portion – For posterior sacro-iliac ligaments.

PORTION OF INNER SURFACE OF TRUE PELVIS – Corresponding to upper part of acetabulum.

Upper Border or Crest – Convex from before backwards, curved like an italic *f*, concave externally behind, where it is thickest, convex externally in front, where it is also very thick, divided into:

Outer lip for latissimus dorsi, obliquus externus, tensor vaginæ femoris & fascia lata.

Inner lip for erector spinæ, quadratus lumborum & transversalis;

Interspace for internal oblique.

Anterior Border – Long, concave, nearly vertical; presents from above downwards:

Anterior superior spine for Poupart's ligament, sartorius, tensor vaginæ, femoris & iliacus;

Notch for lower fibres of sartorius, and exit of external cutaneous nerve;

Anterior inferior spine for straight tendon of rectus;

Broad shallow groove for exit of psoas & iliacus.

Posterior Border — Shorter, more horizontal. Presents:

Posterior superior spine for erector spinæ & oblique srcro-iliac ligament;

Slight notch;

Posterior inferior spine for part of great sacro-siatic ligament;

Upper part of great sacro-sciatic notch.

THE INNOMINATE BONE—2nd Tablet.

ISCHIUM — The lower, posterior & thick part. Bounds obturator foramen below & behind, and presents body, tuberosity & ascending ramus.

Body – Presents three surfaces & three borders:

Outer Surface – Presents from above downwards:
- *A little more than 2-5ths of the acetabulum* comprising the greater part of the central non-articular depression;
- *Lower part of rim of acetabulum with a portion of the cotyloid notch;*
- *Deep groove* for passage of tendon of obturator externus;
- *Posterior part of circumference of obturator foramen* for obturator externus & adductor magnus.

Inner Surface – Forms lower part of lateral boundary of true pelvis & posterior part of circumference of obturator foramen. It gives origin to obturator internus, presents two or three large vascular foramina, and is grooved inferiorly for passage of pudic vessels & nerve.

Posterior Surface – Quadrilateral, smooth, broadest above, supports the pyriformis, obturator internus, & gemelli.

Anterior Border – Thin; for obturator membrane.

Outer Border – Thick & short.

Inner Border – The longest. Presents from above downwards:
- *Lower part of great sacro-sciatic notch.* – This notch is converted by lesser sacro-sciatic ligament into great sacro-sciatic foramen, which foramen transmits from above downwards:
  - *Gluteal vessels & superior gluteal nerve;*
  - *Pyriformis muscle;*
  - *Sciatic artery, greater & lesser sciatic nerves, pudic vessels & nerve, & nerve to obturator internus;*
- *Spine of ischium* – For lesser sacro-sciatic ligament, gemellus superior, coccygeus, & posterior fibres of levator ani.
- *Lesser sacro-sciatic notch* – Coated with fibro-cartilage, and converted by both sacro-sciatic ligaments into lesser sacro-sciatic foramen for obturator internus muscle, its nerve, and pudic vessels & nerve.

Tuberosity – Corresponds to lower and back part of body, and may be described as presenting:

Outer Lip – For gemellus inferior, quadratus femoris, & adductor magnus.

Inner Lip – For transversus perinæi, crus penis or clitoridis, erector penis or clitoridis, & anterior or falciform prolongation of great sacro-sciatic ligament.

Interspace – Presents four rough surfaces:
- *Two Anterior or Inferior* separated by a prominent ridge,
  - *the external,* for the adductor magnus;
  - *the internal* for the great sacro-sciatic ligament.
- *Two Posterior or Superior* separated by a rough line oblique downwards & outwards,
  - *the external* (the most superior of the two), for semimembranosus;
  - *the internal* (the most inferior of the two) for common tendon of semitendinosus & long head of biceps.

Ascending Ramus – Thin & flattened; passes upwards & inwards, bounding obturator foramen inferiorly, and joins with descending ramus of pubes. Presents:

Outer Surface – Rough, for gracilis, obturator externus & adductor magnus.

Inner Surface – Smoother, for obturator internus.

Upper Border – Thin & sharp, for obturator membrane.

Lower Border – Rough, thick; everted, especially in the female; for gracilis, crus penis or clitoridis, erector penis or clitoridis, transversus perinæi, deep perinæal fascia, & deep layer of the superficial fascia.

THE INNOMINATE BONE—3rd Tablet.

PUBES — The anterior & inner part. Bounds obturator foramen above & in front, and pr sents body, horizontal ramus & descending ramu

Body — Quadrilateral, flattened from before backwards & outwards, and presents:

ANTERIOR SURFACE – Rough, slightly excavated, giving origin to the adduct longus immediately below the crest, and, lower down, to obturat externus, adductors brevis & magnus, & upper part of gracil

POSTERIOR SURFACE – Smooth, convex from above downwards, concave from si to side, giving attachment to obturator internus, levator ani, a pubo-prostatic ligaments or anterior true ligaments of bladd

UPPER BORDER – Presents from within outwards the
- *Angle* – In front of which the inner pillars of external abdominal ring cussate with each other (as they do also in front of symphysis
- *Crest* – To which are attached, anteriorly the conjoined tendon of internal oblique & transversalis, and posteriorly the rectus pyramidal
- *Spine* – For Poupart's ligament & outer pillar of external abdominal rin
- *Commencement of ilio-pectineal line,* for conjoined tendon, Gimbernat's li ment & the triangular ligame

INNER BORDER – Presents a rough oval facet, which forms part of symphysis.

OUTER BORDER – Thin, for obturator membrane.

Horizontal Ramus – Is far from being horizontal, since it forms part of the brim f the true pelvis, which brim is inclined at an angle of about with the horizontal. Prese :

UPPER SURFACE – Presents from within outwards:
- *Triangular surface* for origin of pectineus, behind which surface is the
  - *Continuation of the ilio-pectineal line* already mentioned;
- *Ilio-pectineal eminence,* which supports brim of acetabulum, and gives atta ment to psoas parvus when that muscle exi

UNDER SURFACE – Presents a
- *Groove* oblique forwards & inwards for obturator vessels & ne , which groove is bounded internally l a
- *Sharp margin* forming part of circumference of obturator foramen

POSTERIOR SURFACE – For upper fibres of obturator internus; forms part of a rior boundary of true pe s.

OUTER EXTREMITY – Forms about 1-5th of the acetabulum.

Descending Ramus – Thin & flattened; passes downwards & outwards, and is with ascending ramus of ischium. Prese s:

ANTERIOR SURFACE – Rough, for adductors brevis & magnus, obturator exte us & gra is.

POSTERIOR SURFACE – Smoother, for obturator internus.

INNER BORDER – Rough, thick; everted, especially in the female; for gra is, crus penis or clitoridis, erector penis or clitoridis, compr or urethræ, deep perinæal fascia, & deep layer of the superficial fa a.

OUTER BORDER – Thin & sharp, for obturator membrane.

HE INNOMINATE BONE—4th Tablet.

ACETABULUM, or COTYLOID CAVITY — Deep, hemispherical, formed by all the three parts which make up the innominate bone: – the ilium forming a little less than 2-5ths, including the largest part of the articular ring; the ischium forming a little more than 2-5ths, including the greater part of the central non-articular depression; the pubes forming the remaining 1-5th.

Looks downwards, forwards, & outwards.

Is surrounded, except below & in front, by an elevated margin for attachment of the cotyloid ligament. This margin is most prominent behind, is slightly depressed between the pubes & the ilium, and is deficient between the pubes & the ischium, in which latter situation the resulting

Cotyloid notch – Leads into the central non-articular depression; the margins of this notch give attachment to the round & transverse ligaments.

Is divided into an

Incomplete Articular Ring – Broadest in its iliac portion, which portion is the most extensive of the three, & deficient opposite the cotyloid notch; and a

Central Non-Articular Depression – Rough, nearly circular, continuous with the cotyloid notch, and formed chiefly by the ischium; this depression lodges a mass of fat which forms a bed for the round ligament.

OBTURATOR or THYROID FORAMEN, or FORAMEN OVALE— Comprised between the pubes & ischium; large & oval in male; smaller, triangular, narrow inferiorly in female. Closed by obturator membrane, except in its upper part, where the upper border of the membrane converts the groove on under surface of horizontal ramus into a complete foramen for obturator vessels & nerve.

THE FEMUR

The largest, longest, & strongest bone of the skeleton; slightly oblique downwards & inwards, especially in

UPPER EXTREMITY — Presents:

Head – Forms nearly two-thirds of a sphere, and looks upwards forwards & inwards. Presents below & behind its centre a small c

Depression for ligamentum teres.

Neck – Flattened from before backwards, expanded inferiorly, thicker above than below, bounded intertrochanteric lines. Longest & most inclined in youth; shorter and more ho as age advances, especially in female. Pr

Ant. Surface – Continuous with anterior surface of shaft, perforated by numerous vascular fo

Posterior Surface – Concave, rather broader; gives attachment externally to posterior capsule of hi

Upper Border – Short, thick, horizontal.

Lower Border – Longer, thinner, oblique downwards & backwards to lesser trochanter.

Greater Trochanter – Large, quadrilateral, most prominent posteriorly. Presents:

Outer Surface – Presents

Oblique line extending downwards & forwards, for gluteus medius; – the surface is below & behind this line for a bursa, and sometimes rough above & in front f of the fibres of gluteus

Inner Surface – Presents the

Digital or trochanteric fossa for obturator externus.

Upper Border – For obturator internus & gemelli in front, & pyriformis behind.

Lower Border – Marked externally by a rough

Horizontal ridge for vastus externus.

Anterior Border – Rough above & externally for gluteus minimus, below & internally fo externus. On its inner side towards its middle is a rough promine

Tubercle of the femur, which marks point of meeting of gluteus minimus, vastus exter obturator internus & gemelli (Gray), and is continued inferiorly

Anterior intertrochanteric line, less prominent than the posterior, oblique downwards & i rough for front part of capsule; joins inferiorly with superior internal prolong

Posterior Border – Longer, more prominent; continued inferiorly into the

Posterior intertrochanteric line prominent, oblique downwards & inwards to lesser tro presents towards its middle the upper extrem

Linea quadrati for quadratus femoris.

Lesser Trochanter – Smaller, conical, for psoas; lies at lower inner & back part of neck, at meeting of posterior intertrochanteric line, lower border of neck, and superio prolongation of line

LOWER EXTREMITY — Expanded, broad from side to side. Presents posteriorly the deep

Intercondyloid Notch – Which separates posteriorly the condyles, which latter are joined in patellar portion of their articular

Inner Condyle – The longest, narrowest, most curved, and most prominent inferiorly when th held vertically;

Inner tuberosity, more prominent than the external; gives attachment to interna ligament of k

Tubercle, for tendon of adductor magnus, at upper & back part;

Depression for inner head of gastrocnemius, above & behind articular surface;

Outer rough surface forming part of intercondyloid notch, & giving attachment ant posterior crucial

Outer Condyle – The shortest, broadest, least curved, & most prominent anteriorly; presents:

Outer tuberosity, less prominent than the internal; gives attachment to external lat ment of k

Pit & oblique groove for popliteus, below & externally;

Depression for outer head of gastrocnemius, above & behind articular surface;

Inner rough surface forming part of intercondyloid notch, and giving attachment p to anterior crucial

ARTICULAR SURFACE — Is divided anteriorly into a patellar & two tibial portions by tw depressed posteriorly converging lines, of which the one that bounds th portion internally is continued backwards along outer & front part of inner c as to cut off an additional narrow tract from inner side of intercondyl

Patellar Portion – Occupies front of condyles, is trochlear in shape, broadest, highe prominent externally, and presents a slight prolongation backwards along in intercondyloid notch; it is this prolongation that articulates during flexion joint with the small facet on posterior aspect of inner border of patella (Lenoir,

Tibial Portion – Covers the slightly flattened under surfaces & the posterior rounded s the

SHAFT — Nearly cylindrical, convex forwards & outwards, enlarged & flattened from before backwa

Borders – Three:

Posterior, or Linea Aspera – Very prominent; for vasti, adductors longus, brevis, short head of biceps; trifid above, below below, presenting therefore five prolo

Superior External – To great trochanter, for vastus externus, gluteus maximus & of adducto

Superior Internal – To inner side of neck, where it joins with anterior intertrochan for upper part of vastu

Superior Median – To lesser trochanter, for iliacus, pectineus & upper part of adduc

Inferior External – To upper & back part of outer condyle, for vastus externus, sh biceps, plantaris, & outer head of gast

Inferior Internal – Faintly marked where it is crossed by femoral artery, to upp part of inner condyle, for vastus internus, adductor magnus & inner head nemius. – These two latter prolongations embrace a triangular surface, whic the popliteal vessel

Internal – From inner side of neck to front of inner condyle;

External – From front of great trochanter to front of outer condyloid, – both rounded & faint

Surfaces – Three; all broadest below:

Anterior – For subcrureus & inner part of crureus; covered below by upper part of

External – For outer part of crureus; covered by vastus externus.

Internal – For vastus internus.

THE TIBIA

Prismoid, expanded above, slightly enlarged below, twisted outwards inferiorly, oblique downwards & outwards in female. Presents:

- **UPPER EXTREMITY or HEAD** — Broad from side to side, and formed by inner & outer tuberosities which tuberosities correspond to & support condyles of femur, and are separated by a slight notch both in front & behind. Presents:
  - **Upper Surface** – Presents the two condyloid surfaces, oval & slightly elongated from before backwards, and separated from each other by the spine and by two rough triangular depressions situated one in front of the spine & the other behind it.
    - INTERNAL CONDYLOID SURFACE – The longest, narrowest, & deepest.
    - EXTERNAL CONDYLOID SURFACE – The shortest, broadest, & shallowest.
    - SPINE – Surmounted by two prominent tubercles formed by the prolongation backwards & inwards, and forwards & inwards, respectively, of the internal & external condyloid surfaces.
    - ANTERIOR ROUGH DEPRESSION – The largest; gives attachment from before backwards to anterior extremity of internal semilunar fibro-cartilage, anterior crucial ligament, anterior extremity of external semilunar fibro-cartilage.
    - POSTERIOR ROUGH DEPRESSION – Rather smaller; gives attachment from before backwards to posterior extremities of external & internal semilunar fibro-cartilages & to posterior crucial ligament.
  - **Outer Surface** – Presents outer surface of outer tuberosity, which tuberosity is the least prominent of the two, and is marked posteriorly by a small circular
    - *Facet* looking downwards, outwards & backwards, for fibula.
  - **Inner Surface** – Presents inner surface of inner tuberosity, which tuberosity, the more prominent of the two, gives attachment to internal lateral ligt. of knee-joint, and is marked by a
    - *Groove* for insertion of one of the tendons of semimembranosus.
  - **Anterior Surface** – Presents a large rough triangular surface, perforated by numerous vascular foramina, broad above, ending inferiorly in the
    - *Tubercle of the tibia* rough inferiorly for ligamentum patellæ, smooth superiorly for a bursa.
  - **Posterior Surface** – Presents the posterior aspect of the tuberosities, which are separated by the
    - *Popliteal notch* for posterior crucial ligament & part of posterior ligament of knee-joint.
    - The inner tuberosity gives attachment posteriorly to one of the tendons of semimembranosus & to principal fasciculus of foregoing ligament.
- **LOWER EXTREMITY** — Smaller, quadrangular. Presents:
  - **Inferior or Articular Surface** – Quadrilateral, concave from before backwards, broadest in front, narrowest internally, where it is continuous with inner surface of internal malleolus, marked by a
    - *Slight antero-posterior elevation* separating two
    - *Shallow lateral-depressions.*
  - **Anterior Surface** – Broad, convex, smooth, covered by tendons of tibialis anticus, extensor proprius pollicis & extensor longus digitorum, and marked inferiorly by a
    - *Slight groove* for anterior ligament of ankle-joint.
  - **Posterior Surface** – Rather narrower; presents a
    - *Broad shallow groove*, oblique downwards & inwards for tendon of flexor longus pollicis.
  - **Inner Surface** – Prolonged downwards into the
    - INTERNAL MALLEOLUS – Shorter, but rather broader than the external, and presents: –
      - *Inner Surface* – Subcutaneous, convex;
      - *Outer Surface* – Articular; deepens internally the articular surface for astragalus.
      - *Anterior Border* – Rough, for anterior portion of deltoid ligament.
      - *Posterior Border* – Presents a
        - *Broad & deep groove*, oblique downwards & inwards, divided by a slight ridge into inner & outer portions for tendons of tibialis posticus & flexor longus digitorum.
      - *Apex* – Rough & slightly grooved for middle portion of deltoid ligament.
  - **Outer Surface** – Bounded by branches of bifurcation of inner border; presents inferiorly a
    - *Narrow concave facet* for external malleolus, and superiorly a
    - *Rough triangular depression* for interosseous ligament of inferior tibio-fibular articulation.
- **SHAFT** — Triangular, expanded above & below, narrowest at junction of middle & lower thirds; presents:
  - **Borders** – Three:
    - ANTERIOR OR CREST – From tubercle of tibia to anterior border of internal malleolus; curved like an italic *S*, concave externally above, internally below; very prominent in upper two-thirds; for deep fascia of leg.
    - INTERNAL – From back of inner tuberosity to posterior border of internal malleolus; gives attachment to popliteus, soleus & flexor longus digitorum.
    - EXTERNAL, OR INTEROSSEOUS RIDGE – From front of fibular facet to apex of triangular rough surface on outer side of lower extremity, to embrace which it bifurcates inferiorly; thin & prominent, especially towards middle.
  - **Surfaces** – Three:
    - INTERNAL – Smooth, convex, subcutaneous, except at upper part, where it gives attachment to tendons of sartorius, gracilis & semitendinosus.
    - EXTERNAL – Excavated in upper two-thirds for origin of tibialis anticus; rounded off & curved forwards anteriorly in lower third, where it is covered by tendons of tibialis anticus, extensor proprius pollicis & extensor longus digitorum.
    - POSTERIOR – Presents superiorly a large
      - *Triangular surface* for popliteus, which surface is bounded below by the
      - *Oblique line* for popliteus, soleus, tibialis posticus & flexor longus digitorum. Below this line is the
      - *Nutrient foramen* directed downwards, and a
      - *Vertical ridge*, which divides middle third of posterior surface into
        - *Inner broader portion* for flexor longus digitorum, and
        - *Outer narrow portion* for tibialis posticus; and then becomes lost inferiorly upon a
      - *Smooth surface* covered by tendons of tibialis posticus, flexor longus digitorum, & flexor proprius pollicis.

THE FIBULA—1st Tablet.

Very slender, and of about the same length as the tibia. Inclined downwards & forwards, convex posteriorly, convex internally below. Presents a shaft & two extremities.

SHAFT — Presents *four* borders & *four* surfaces. – (For classical description, see next Tablet).

Borders – Are:

Antero-external – Usually called anterior. Well marked & prominent. Commences at front of head. Descends along upper 3-4ths of the bone, slightly deviating outwards inferiorly, and bifurcates below to embrace the triangular subcutaneous surface above external malleolus. It gives attachment to the septum between the extensor muscles & the peronei.

Antero-internal, or Interosseous Ridge – Lies close to the preceding, especially at the upper part of the bone, where it is sometimes rather indistinct. It inclines inwards inferiorly, and blends, in the lower 1-4th of the bone, with the oblique line, with which oblique line it ends at apex of triangular rough surface above articular facet of external malleolus.

Postero-external – Usually called posterior. – Well marked & prominent Extends from styloid process to inner lip of groove on posterior border of external malleolus, being directed, in succession, outwards, backwards, backwards & inwards. It gives attachment to the septum between the peronei & the flexor muscles

Postero-internal, or Oblique Line – Commences at inner side of head, mos marked in upper & middle parts of the bone. Blends in lower fourtl with the antero-internal border or interosseous ridge, with which latte it ends at the apex of the triangular rough surface above articular face of external malleolu

Surfaces – Are:

Anterior – Very narrow above, rather broader & slightly grooved below; fo extensor longus digitorum, extensor proprius pollicis peroneus tertius

External – Broad, more or less grooved for peronei. Looks in succession fo wards & outwards, outwards, backwards & outwards, and is continue inferiorly into the groove on back of external malleolu

Internal – Comprised between the antero-internal border or interosseous ridg and the postero-internal border or oblique line, and exists only in tl upper 3-4ths of the bone. Rather narrow, but less so than the anteri surface, slightly grooved for tibialis posticu

Posterior – Comprised between the postero-external border & the oblique lin Broad, looking inwards below; for soleus & flexor longus pollici Presents towards its middle the nutrient foramen, which is direct downwar

UPPER EXTREMITY, or HEAD — Small, pyramidal. Rough in front, externally, behind respectively fo

peroneus longus & anterior ligament of superior tibio-fibular art ulatio

tendon of biceps, & long external lateral ligament of knee-joint.

soleus, & posterior ligament of superior tibio-fibular articulation

Prolonged upwards externally into the

Styloid process, for short external lateral ligament of knee-joint.

Presents internally a small

Articular facet looking upwards & inwards, which facet articula with outer tuberosity of tib

LOWER EXTREMITY, or EXTERNAL MALLEOLUS — Rather larger th head, flattened from within outwards, and descends lower than inter malleolus. Presen

Surfaces:

Outer – Subcutaneous, convex, prolonged upwards between the divisions the antero-external bord

Inner – Presents:

Above & in Front – Articular facet for astragalus, triangular with b upwards, convex from above downwards, surmounted by rough triangular impression for interosseous ligament of infe tibio-fibular articulat

Below & Behind – Rough & deep depression for posterior fasciculus external lateral ligament of ankle-jo

Borders:

Anterior – Thick & rounded, for anterior fasciculus of external lateral li ment of ankle-jc

Posterior – Broader, and marked by a groove for tendons of peronei.

Apex – Rounded, for middle fasciculus of external lateral ligament of ankle-joint.

HE FIBULA—2nd Tablet.

CLASSICAL DESCRIPTIONS OF THE SHAFT.

There are in this country two different classical descriptions of the shaft of the fibula; the one is given by Holden, Quain, & Wilson; the other by Gray. Both descriptions recognise *three* borders & *three* surfaces, and, at first sight, they appear identical. They are far from being so, however, for of the three borders enumerated in both, there are but two that correspond, viz., the *anterior* & the *posterior* (antero-external & postero-external borders of the Author); and of the three surfaces, there is but one, the *external*, respecting which the descriptions agree.

Of the two ridges which exist on the inner aspect of the bone, the *interosseous ridge* & the *oblique line* (which ridges the Author has described respectively as the antero-internal & postero-internal borders), the latter ridge is taken as the inner border of the bone by Holden, Quain, & Wilson, while it is the former that is called the inner border by Gray.

This first & apparently slight difference brings about other & more important discrepancies in the delimitation & designation of the surfaces: – Thus we find on the inner aspect of the bone:

An Inner Surface & a Posterior Surface (Holden, Quain, Wilson);
An Anterior Surface & an Inner Surface (Gray);

Gray's "*Inner Surface*" surface being however very different from the "*Inner Surface*" of Holden, Quain, & Wilson, as will immediately appear: –

Holden, Quain, & Wilson's "Inner Surface" – Is the smallest of the three. It is bounded in front by the anterior border of the bone (antero-external border of the Author), and behind by the oblique line above mentioned. It is divided by the *interosseous ridge* into an "*anterior portion*" for extensor longus digitorum, extensor proprius pollicis & peroneus tertius, and a "*posterior portion*" for tibialis posticus.

Gray's "Inner Surface" – Is on the contrary the largest, and occupies nearly two-thirds of the circumference of the bone; it is bounded in front by the interosseous ridge, behind by the posterior border (postero-external border of the Author). It is divided by the *oblique line* into an "*anterior portion*" for tibialis posticus, (corresponding to the "*posterior portion*" of the former "*inner surface*,") and a "*posterior portion*" for soleus & flexor longus pollicis.

On the other hand

Holden, Quain, & Wilson's "Posterior Surface" (and the POSTERIOR SURFACE of the Author, for they are identical) – Are but the posterior part of the "INNER SURFACE" of Gray; – and

Gray's "Anterior Surface" (and the ANTERIOR SURFACE of the Author, for they are both the same) – Are but the anterior part of the "INNER SURFACE" of Holden, Quain, & Wilson.

It is with the hope of clearing up difficulties which have puzzled many, that the Author has presented a third & original description of the shaft of the fibula, and that he has ventured to compare & discuss the descriptions of the bone as given by eminent and well-known anatomists.

BONES of the TARSUS — 1st Row.

THE ASTRAGALUS

Supports the tibia, rests upon the os calcis, articulates on either side with the malleoli & in front with scaphoid. Is irregularly cuboid, and presents six surfaces.

Upper Surface – Presents:

TROCHLEAR SURFACE – Broadest in front, convex from before backwards, slightly concave from side to side; in front of which surface is the

Upper Surface of the Neck – Rough for ligaments.

Under Surface – Presents:

Deep Groove – Directed forwards & outwards and broadest in front, for interosseous calcaneo-astragaloid ligament; this groove separates

TWO ARTICULAR FACETS – For os calcis; the posterior one, the largest, is concave; the anterior one, the smallest, is convex, continuous with the anterior articular surface and sometimes divided into two parts, one for lesser process of os calcis, one for calcaneo-scaphoid ligament.

Inner Surface – Presents:

TRIANGULAR ARTICULAR FACET – Small, continuous with trochlear surface, for internal malleolus; below this facet is a

Rough Groove – For deep portion of internal lateral ligament of ankle-joint.

Outer Surface – Presents:

TRIANGULAR ARTICULAR FACET – Much larger, concave from above downwards, also continuous with trochlear surface; in front of which is a

Deep Depression – For anterior fasciculus of external lateral ligament of ankle-joint.

Anterior Surface – Forms the

HEAD – Oval, oblique downwards & inwards, & convex for scaphoid, continuous inferiorly with anterior facet of under surface, and supported by a constricted part, the

NECK.

Posterior Surface – Very narrow, and represented merely by a slight

Groove – Oblique downwards & inwards for tendon of flexor longus pollicis.

THE OS CALCIS

Irregularly cuboid; presents six surfaces.

Upper Surface – Presents from before backwards:

Upper Surface of Greater Process – Presenting a rough depresssion for extensor brevis digitorum;

TWO ARTICULAR SURFACES – For astragalus, and an intervening *deep groove* oblique forwards & outwards, and broadest in front for interosseous calcaneo-astragaloid ligament. – The posterior & external facet is convex, the largest, and situated on the body of the bone. The anterior or internal facet is concave, the smallest, and situated on the lesser process; it is sometimes divided into two.

Rough Saddle-shaped Surface – Belonging to the portion of the bone which projects backwards to form the heel.

Under Surface – Rough, convex from side to side, widest behind. Presents from behind forwards:

Two Tubercles – The internal, the largest, for abductor pollicis & flexor brevis digitorum; the external, the smallest, for abductor minimi digiti.

Rough Surface – For outer head of flexor access. & long calcaneo-cuboid ligt.

Tubercle & Transverse Groove – For short calcaneo-cuboid ligament.

Inner Surface – Concave for passage of vessels, nerves, & flexor tendons. Gives attachment to inner head of flexor accessorius, and is surmounted by the

LESSER PROCESS, OR SUSTENTACULUM TALI – Which articulates above with the astragalus, is grooved inferiorly for tendon of flexor longus pollicis, and gives attachment by its inner margin to a part of the superficial fibres of the internal lateral ligament of the ankle-joint.

Outer Surface – Presents towards its middle a

Tubercle – For middle fasciclus of external lateral ligament of ankle-joint; and in front of the tubercle,

Two Grooves – Separated by a slight ridge for tendons of peronei.

Anterior Surface – Concavo-convex for articulation with cuboid; is surmounted externally by a rough prominent tubercle which is an important guide in Chopart's amputation.

Posterior Surface – Rough & broad below for insertion of tendo Achillis & plantaris muscle, narrow & smooth above, where it is covered by a bursa.

BONES of the TARSUS — 2nd Row.

THE SCAPHOID — Presents:

Anterior Surface – Convex, broadest externally; presents *three triangular facets* for the cuneiform.

Posterior Surface – Concave, for head of astragalus, also broadest externally.

Circumference – Rough, convex above, concave below. Presents below & internally a *tubercle,* for tendon of tibialis porticus; and sometimes externally a *facet,* for cuboid.

THE CUBOID — Presents:

Articular Surfaces – Three:

Anterior – Presents two facets,
- *inner,* smaller, quadrilateral for 4th metatarsal,
- *outer,* larger, triangular for 5th metatarsal.

Posterior – Quadrilateral, concavo-convex for os calcis.

Internal – Presents towards middle & upper part a *large anterior facet* for external cuneiform; and sometimes behind this a *smaller posterior facet* for scaphoid. – The remainder of this surface is rough for ligaments.

Non-Articular Surfaces – Three:

Superior – Rough, oblique downwards & outwards.

Inferior – Presents from before backwards:
- *deep groove* oblique forwards & inwards, which transmits tendon of peroneus longus, and is bounded behind by a prominent
- *ridge* for long calcaneo-cuboid ligament, which ridge begins externally in a prominent
- *tubercle* presenting a small facet for a sesamoid bone;
- *rough surface* for short calcaneo-cuboid ligament, and part of the flexor brevis pollicis.

Outer – A mere border notched by commencement of peroneal groove.

THE CUNEIFORM BONES

Three, wedge-shaped, & six sided. All three present

COMMON CHARACTERS:

Dorsal Surf. – Quadrilateral, and rough for ligaments. Looks obliquely inwards in the internal cuneiform, in which bone it also presents a small groove or facet for tendon of tibialis anticus.

Plantar Surf. – Rough rounded border in the two outermost. In the innermost it is a broad rough surface marked behind by a tubercle for the tibialis posticus.

Posterior Surf. – Triangular & concave from above downwards. They articulate with the three facets on anterior surface of scaphoid, and lie in the same transverse line.

Anterior Surf. – Triangular in the two outermost, kidney-shaped in the innermost; they articulate with the bases of the three innermost metatarsal bones. These surfaces present an indented outline: the middle cuneiform being shorter than the two others, its anterior surface is depressed.

Lateral Surf. – Articulate with each other, the cuboid, both sides of the base of the 2nd metatarsal bone & the inner side of the base of the 4th; the lateral surfaces of the 3rd cuneiform presenting each of them two facets, and the adjoining surfaces of the 1st & 2nd presenting a facet angular in shape & running along the superior & posterior borders. The inner surface of the internal cuneiform is a mere rounded border.

DISTINCTIVE CHARACTERS

BETWEEN THE THREE BONES.

First – Large size, irregular form, anterior kidney-shaped surface, facet for tibialis anticus, tubercle for tibialis posticus.

Second – Small size, square-shape of dorsal surface, angular articular facet along the upper & back part of its inner surface.

Third – Intermediate size, two facets on both of its lateral surfaces.

BETWEEN THE BONES OF THE TWO SIDES — Are evident in the case of the first & second cuneiform. To have the three points necessary to place the third one in position all that is requisite is to remark that the ant. internal facet is rather larger than the ant. external.

THE METATARSAL BONES.

Long bones with shaft & two extremities.

COMMON CHARACTERS:

Shaft – Prismoid, concave inferiorly, slightly tapering towards digital end. Present:

Dorsal Surface – Triangular, pretty well marked behind, but reduced to a mere border in greatest part of its extent, covered by extensor tendons.

Lateral Surfaces – Divided by a ridge into two parts for plantar & dorsal interossei.

Tarsal Extremity or Base – The largest; cuboid. Presents:

Dorsal & Plantar Surfaces – Rough, the former of which is the largest.

Posterior & Lateral Surfaces – Artic. with bones of tarsus & adjoining metatarsal bs.

Digital Extremity or Head – Smaller, compressed from side to side. Presents:

Ant. or Articular Surface – Rounded, extending farther backwards below than above.

Lateral Surfaces – Depressed; present a prominent tubercle for lateral ligament of corresponding metatarso-phalangeal articulation.

Plantar Surface – Narrow; grooved for flexor tendons.

Dorsal Surface – Narrow & flat.

PARTICULAR CHARACTERS:

FIRST METATARSAL BONE — The shortest & much the thickest.

Shaft – Very thick & strong.

Tarsal Extremity – Presents a large semilunar facet for internal cuneiform, but has n lateral articular facets. It is prolonged below & externally into a prominen tubercle for tendon of peroneus longus

Digital Extremity – Large & broad. Presents inferiorly two grooved facets for sesamoid bs

SECOND METATARSAL BONE — The longest; received posteriorly into the reces between the three cuneiform bones

Tarsal Extremity – Presents:

Tarsal Facet – Triangular, for middle cuneiform.

Lateral Facets – Three: – One internal for internal cuneiform; two external for ex ternal cuneiform & 3rd metatarsal. These two latter facets are often divide into upper & lower halves by a rough horizontal groove for an interosseous ligt

THIRD METATARSAL BONE — A little shorter.

Tarsal Extremity – Presents:

Tarsal Facet – Triangular, for external cuneiform.

Lateral Facets – Two: – One internal & one external for 2nd & 4th metatarsal bs.; th former facet is often divided into upper & lower halves by an interosseous groov

FOURTH METATARSAL BONE —

Tarsal Extremity – Presents:

Tarsal Facet – Quadrilateral, for cuboid.

Lateral Facets – Three: – One ext. for 5th metatarsal, two int. for 3rd metatarsal & e ternal cuneiform; the facet for the external cuneiform being sometimes absent

FIFTH METATARSAL BONE — The shortest but one.

Tarsal Extremity – Presents:

Tarsal Facet – Triangular, cut obliquely forwards & inwards, for cuboid;

Internal Lateral Facet – For 4th metatarsal;

Prominent External Tubercle – For peroneus brevis.

N.B. — The foregoing characters supply the three points requisite to place the bones position, and therefore to distinguish between right bones and left bone

THE PHALANGES

Fourteen; three, which are smaller than corresponding phalanges of hand, to the four outer toes, two which are larger than corresponding phalanges of hand, to the big toe. Ar long bones, and present

Shaft – Slightly curved inferiorly, compressed from side to side & narrowed towards middle Convex from side to side on dorsal surf.; flat on plantar surf., which is very nar row & bounded by two prominent margins for attachment of sheaths of flexo tendons. – The shaft is longer in first or proximal phalanges than in second, i second than in third. It is exceedingly short in second phalanges of 4th & 5th toes

Proximal Extremity – The largest. Presents:

In First Row – Oval, concave, articular surface, broadest from side to side.

In Second & Third Rows – Two lateral concavities & a median ridge.

Distal Extremity – The smallest. Presents:

In First & Second Rows – A trochlear surface prolonged farther backwards belo than abov

In Third Row – A rough horse-shoe shaped eminence on plantar surface.

THE PATELLA.

Flat, triangular, situated at front of knee-joint. Is regarded by some as a sesamoid bone developed in tendon of quadriceps extensor femoris, by others as the homologue of the olecranon. Presents two surfaces, three borders, & an apex.

SURFACES — Are:

Anterior – Subcutaneous, convex, marked by rough vertical striæ, & perforated by numerous vascular foramina; is covered by an expansion of tendon of quadriceps, the fibres of which expansion are continuous with superficial fibres of ligamentum patellæ.

Posterior – Divided into:

Upper or Articular Portion – Corresponds to upper three-fourths of the surface, and is divided by a prominent vertical ridge into two concave facets, of which the inner one, the smallest & shallowest, is further diminished by a slightly marked vertical ridge, which vertical ridge cuts off a narrow marginal portion corresponding to the inner border of the bone; this marginal portion comes in contact during flexion of the knee-joint with the inner border of the intercondyloid notch (Lenoir, Goodsir). – In well marked bones the two concave facets are divided by two transverse ridges into three horizontal bands, which rest in succession upon the femoral trochlea during the movements of flexion & extension of the joint (Goodsir).

Lower or Non-articular Portion – The lower fourth; forms a rough transverse groove for attachment of greater part of ligamentum patellæ.

BORDERS — Are:

Superior – Thick, cut obliquely at expense of anterior surface, for tendons of rectus & crureus.

Lateral – Thinner, converging inferiorly, for tendons of vasti & capsule of knee-joint. – The inner border is marked posteriorly by the small marginal facet above mentioned.

APEX — Directed downwards; forms part posteriorly of rough groove above mentioned for ligamentum patellæ.

THE HYOID BONE.

Horse-shoe shaped, and suspended by stylo-hyoid ligaments from tips of styloid processes of temporal bones. Consists in youth of five parts, the body and the greater & lesser cornua, which parts are joined together by four arthrodiæ; the cornua usually join with the body, the greater ones towards the middle period of life, the lesser ones in advanced age.

BODY — Quadrilateral. Presents:

Anterior Surface - Convex, looks upwards & forwards, and is marked by a crucial ridge. The part above the ridge gives attachment to the hyo-glossus, genio-hyo-glossus & genio-hyoid; the part below the ridge gives attachment to the mylo-hyoid, the stylo-hyoid & the aponeurosis of the digastric.

Posterior Surface - Smooth, concave; looks backwards & downwards, and is separated from the epiglottis & the thyro-hyoid membrane by a quantity of loose areolar tissue, in which a bursa is usually found.

Upper Border - Thick & rounded; gives attachment to genio-hyo-glossus by its anterior lip, to thyro-hyoid membrane by its posterior lip.

Lower Border - Thinner; gives attachment to sterno-, omo-, & thyro-hyoid.

GREATER CORNU — Projects backwards & slightly upwards, giving attachment superiorly to the hyo-glossus, internally to the middle constrictor of the pharynx, and externally to the thyro-hyoid. It diminishes in size from before backwards, and is flattened from above downwards. Its slightly enlarged extremity gives attachment to the lateral thyro-hyoid ligament.

LESSER CORNU — Small, conical; projects upwards & backwards from point of junction of body & greater cornu, and gives attachment to the stylo-hyoid ligament.

MUSCLES ATTACHED TO EACH BONE.

MUSCLES ATTACHED to BONES of SKULL.

The muscles attached to the

FRONTAL BONE — Are three in number, and are attached as follows: –
Orbicularis Palpebrarum – Internal angular process.
Corrugator Supercilii – Inner extremity of superciliary ridge.
Temporal – Temporal ridge & surface behind it.

OCCIPITAL — Are eleven in number, and are attached as follows: –
Occipito-Frontalis (Occipital Portion) – Outer two-thirds of superior curved line.
Sterno-Cleido-Mastoid or Sterno-Mastoid – Outer two-thirds of superior curved line.
Trapezius – External occipital protuberance & inner third of superior curved line.
Splenius Capitis – Outer part of rough surface between the superior & inferior curved lin
Complexus – Inner part of rough depression between the two curved lines.
Rectus Capitis Posticus Major – Inner part of inferior curved line & rough surface beneath
Rectus Capitis Posticus Minor – Outer part of inferior curved line & rough surface beneath
Obliquus Capitis Superior – Rough depression between the two curved lines externally complex
Rectus Capitis Anticus Major – Basilar process in front of rectus capitis anticus minor.
Rectus Capitis Anticus Minor – Basilar process behind rectus capitis anticus major.
Rectus Lateralis – Jugular process.

TEMPORAL — Are twelve in number, and are attached as follows: –
Masseter – *Superficial portion*, anterior two-thirds of lower border of zygomatic arch.
Deep portion, posterior third of lower border & inner surface of zygomatic ar
Temporal – Outer surface of squamous portion; temporal ridge.
Sterno-Cleido-Mastoid or Sterno-Mastoid – Anterior border & outer surface of mastoid proc
Splenius Capitis – Posterior border & apex of mastoid process.
Trachelo-Mastoid – Posterior border & apex of mastoid process beneath foregoing.
Retrahens Aurem, or Auricularis Posterior – Outer surface of mastoid process.
Digastric – Digastric groove on inner side of mastoid process.
Levator Palati – Under surface of apex of petrous portion.
Tensor Tympani – Under surface of apex of petrous portion behind & externally to f go
Stylo-Pharyngeus – Inner side of base of styloid process.
Stylo-Hyoideus – Middle of outer surface of styloid process.
Stylo-Glossus – Anterior & outer aspect of apex of styloid process.

SPHENOID — Are eleven in number, and are attached as follows: –
Temporal – Outer surface of greater wing.
Internal Pterygoid – Pterygoid fossa, and more particularly from inner surface of exte l pterygoid pl .
External Pterygoid – Pterygoid ridge & portion of under surface of great wing betwee t & base of pterygoid process; outer surface of external pterygoid pl .
Superior Constrictor – Hamular process & lower third of free margin of internal ptery d pl .
Tensor Palati – Scaphoid fossa at base of internal pterygoid plate.
Internal & Inferior Recti & Lower Head of External Rectus – Through ligament of Z , from whole of circumference of optic foramen, except upper & outer p t.
Superior Rectus & Upper Head of External Rectus – Upper margin & upper part of o r margin of optic forar .
Levator Palpebræ Superioris – Under surface of lesser wing in front of optic foramen & ternally to superior obli .
Superior Oblique – Under surface of lesser wing in front of optic foramen & internall o levator palpebræ superi .

PARIETAL BONE — One, the
Temporal – Temporal ridge & surface below it.

MUSCLES ATTACHED to BONES of FACE.

The muscles attached to the

SUPERIOR MAXILLARY BONE — Are eight in number, and are attached as follows :-
Orbicularis Palpebrarum – Upper part of nasal process.
Levator Labii Superioris Alæque Nasi – Upper part of nasal process below foregoing.
Levator Proprius Labii Superioris – Outer surface of body close to margin of orbit.
Levator Anguli Oris or Musculus Caninus – Canine fossa just below infraorbital foramen.
Compressor Nasi – Lower & inner part of canine fossa.
Depressor Alæ Nasi – Myrtiform or incisor fossa.
Buccinator – Outer surface of alveolar process corresponding to molar teeth.
Inferior Oblique – Depression on orbital plate close to lachrymal groove.

INFERIOR MAXILLARY BONE — Twelve in number, and are attached as follows :-
Temporal – Apex, inner surface & anterior border of coronoid process down to its root.
Masseter – Angle, and outer surface of ramus & of coronoid process.
Internal Pterygoid – Angle and inner surface of ramus as high as dental foramen.
External Pterygoid – Depression on front of neck of condyle.
Digastric – Rough depression on inner lip of lower border of body.
Mylo-Hyoid – Whole length of mylo-hyoid ridge.
Genio-Hyoid – Inferior genial tubercle.
Genio-Hyo-Glossus – Superior genial tubercle.
Buccinator – Outer surface of alveolar process corresponding to molar teeth.
Depressor Anguli Oris or Triangularis Oris – Ext. oblique line externally to mental foramen.
Depressor Labii Inferioris or Quadratus Menti – External oblique line between symphysis & mental foramen.
Levator Labii Inferioris or Levator Menti – Incisor fossa

PALATE BONE — Three in number, and are attached as follows : -
Azygos Uvulæ – Posterior nasal spine.
Internal Pterygoid – Groove on posterior surface of pterygoid process.
External Pterygoid – Front part of outer aspect of pterygoid process.

MALAR BONE — Three in number, and are attached as follows : -
Masseter (Superficial Portion) – Lower border of zygomatic process.
Zygomaticus Minor – Lower & front part of outer surface.
Zygomaticus Major – Back part of outer surface.

LACHRYMAL BONE — One, the
Tensor Tarsi – Ridge & posterior part of outer surface.

THE MUSCLES ATTACHED to the

HYOID BONE — Are nine in number, and are attached as follows: –

Hyo-Glossus – Side of anterior surface of body above crucial ridge, lesser cornu, wh length of greater corn

Genio-Hyo-Glossus – Anterior surface of body above crucial ridge internally to hy gloss

Genio-Hyoid – Anterior surface of body above crucial ridge, in front of foregoing.

Stylo-Hyoid – Anterior surface of body below crucial ridge externally to mylo-hyoid.

Mylo-Hyoid – Anterior surface of body below crucial ridge internally to stylo-hyoid.

Sterno-Hyoid or Sterno-Cleido-Hyoid – Lower border of body internally to omo-hyoid.

Omo-Hyoid – Lower border of body externally to sterno-hyoid.

Thyro-Hyoid – Lower border of body & greater cornu.

Middle Constrictor – Whole extent of upper surface of great cornu, lesser cornu.

MUSCLES ATTACHED to BONES of THORAX.

The muscles attached to the

STERNUM — Are seven in number, and are attached as follows :–

Pectoralis Major – Corresponding half of anterior surface.
Sterno-Cleido-Mastoid or Sterno-Mastoid (*Sternal Portion*) – Upper & outer part of front of first piece.
Sterno-Hyoid or Sterno-Cleido-Hyoid – Upper & back part of first piece.
Sterno-Thyroid – Back of first piece below & internally to sterno-hyoid.
Triangularis Sterni – Lower & lateral parts of posterior surface.
Rectus Abdominis – Side of ensiform appendix.
Diaphragm (*Narrow Central Slip*) – Posterior aspect of ensiform appendix.

FIRST RIB — Are seven in number, and are attached as follows: –

Scalenus Anticus – Tubercle on inner border & upper surface.
Scalenus Medius – Upper surface behind groove for subclavian artery.
First Levator Costarum or Supracostalis – Posterior part of upper surface.
First Digitation of Serratus Magnus – Middle of upper surface & outer border.
First External Intercostal – Outer border.
First Internal Intercostal – Outer border & under surface.
Musculus Accessorius ad Ilio-Costalem, or ad Sacro-Lumbalem – Angle.

SECOND RIB — Are nine in number, and are attached as follows : –

Second & Third Digitations of Serratus Magnus – Middle of upper or outer surface.
Scalenus Posticus – Back of outer surface.
Serratus Posticus Superior – Upper border externally to angle.
Second Levator Costarum or Supracostalis – Upper border between tubercle & angle.
Musculus Accessorius ad Ilio-Costalem, or ad Sacro-Lumbalem – Angle.
First Internal & First External Intercostals – Upper border.
Second External Intercostal – Lower border.
Second Internal Intercostal – Inner lip of groove & inner surface.

RIBS in GENERAL — Are sixteen in number, and are attached as follows: –

Levatores Costarum or Supracostales – Upper border of all between tubercle & angle.
External Intercostals – Lower border of eleven upper, upper border of eleven lower.
Internal Intercostals – Upper border of eleven lower, inner lip of groove on inner surface of eleven upper.
Serratus Magnus – Outer surface & upper border of eight upper.
Pectoralis Minor – Outer surface & upper border of the 3rd, 4th, & 5th near anterior extremity
Serratus Posticus Superior – Upper border of 2nd, 3rd, 4th, & 5th externally to angle.
Cervicalis Ascendens – Angles of the four or five upper.
Subcostales or Infracostales – Inner surface of one rib to inner surface of 1st, 2nd, or 3rd rib above. Vary in size & number, and are most numerous between the lower ribs, and in the neighbourhood of their angles.
Longissimus Dorsi (*Outer Series of Insertions*) – Lower border of nine or ten lower internally to angles.
External Oblique – Outer surface & lower borders of eight lower.
Diaphragm – Inner surface of six or seven lower, interdigitating with transversalis.
Ilio-costalis, or Sacro-Lumbalis – Angles of the six or seven lower.
Musculus Accessorius ad Ilio-costalem, or ad Sacro-Lumbalem – Angles of the six lower internally to tendons of ilio-costalis, angles of the six upper.
Serratus Posticus Inferior – Lower border of four lower externally to angle.
Latissimus Dorsi – Outer surface of the three or four lower.
Quadratus Lumborum – Inner half of lower border of last.

COSTAL CARTILAGES — Are eight in number, and are attached as follows : –

Pectoralis Major – Cartilages of all the true ribs except the 1st or the 7th, or both.
Transversalis – Inner surface of six lower interdigitating with Diaphragm.
Internal Oblique – Lower border of four lower.
Triangularis Sterni – Upper border of 5th, 6th & 7th, inner surface & lower border of 2nd, 3rd, 4th, & 5th.
Rectus Abdominis – Lower border of 5th, 6th & 7th close to ensiform appendix.
Subclavius – First in front of rhomboid ligament.
External Intercostals of Five Lower Spaces – Lower border of cartilage above, upper border of cartilage below.
Internal Intercostals – Upper border of eleven lower, inner surface of eleven upper.

MUSCLES ATTACHED to SPINE—1st Tablet.

The muscles attached to the

ATLAS — Are nine in number, and are attached as follows: –

Longus Colli (*Superior Oblique Portion*) – Tubercle on anterior arch.
Rectus Capitis Anticus Minor – Front of the lateral mass, and root of transverse proces
Rectus Lateralis – Upper surface of transverse process.
Rectus Capitis Posticus Minor – Tubercle on posterior arch.
First Intertransversales – Under surface of transverse process.
Levator Anguli Scapulæ – Tip of transverse process.
Splenius Colli – "
Obliqui Capitis Superior & Inferior – "

AXIS — Are ten in number, and are attached as follows: –

Longus Colli (*Vertical Portion*) – Front of body.
Scalenus Medius – Tip of transverse process.
Levator Anguli Scapulæ – "
Splenius Colli – "
First & Second Intertransversales – Upper & lower borders of transverse process.
Multifidus Spinæ – Tip of spinous process.
Rectus Capitis Posticus Major – "
Obliquus Capitis Inferior – "
First Interspinales – Both lips of lower border of spinous process.

FIVE LOWER CERVICAL VERTEBRÆ — Are twenty in number, and are attach
as follows

Scalenus Anticus – Anterior tubercles of transverse processes of 3rd, 4th, 5th, & 6th.
Rectus Capitis Anticus Major – " " "
Longus Colli (*Superior Oblique Portion*) – Ant. tubercles of transv. processes of 3rd, 4th, & 5
(*Inferior Oblique Portion*) – Anterior tubercles of transverse processes of 5th & 6
(*Vertical Portion*) – Front of bodies of 5th, 6th, & 7th.
Levator Anguli Scapulæ – Posterior tubercles of transverse processes, 3rd, 4th, & 5th.
Cervicalis Ascendens – Posterior tubercles of transverse processes of 4th, 5th, & 6th.
Scalenus Medius – Posterior tubercles of transverse processes of all the five lower.
Transversalis Colli – " " "
Complexus – Transverse process of 7th, articular processes of the three or four v. abo
Intertransversales – Transverse processes of all the five lower.
Trachelo-Mastoid – Articular processes of the three or four lower.
Multifidus Spinæ – Articular processes of the four lower, spinous processes & adjoi
ing portion of the laminæ of all the five low
Semispinales Dorsi – Spinous processes of the the 6th & 7th.
Semispinales Colli – Spinous processes from the axis to the 5th.
Spinalis Colli – Spinous processes of the one or two last cervical, and of the axis & of o
or two vertebræ belo
Supraspinales – Spinous processes of all the five lower.
Interspinales – " "
Trapezius – Spinous process of the 7th.
Rhomboideus Minor – "
Splenius – "
Serratus Posticus Superior – "

MUSCLES ATTACHED to SPINE—2nd Tablet.

The muscles attached to the

DORSAL VERTEBRÆ — Are twenty-five in number, and are attached as follows: -
Trapezius – Spinous processes of all.
Latissimus Dorsi – Spinous processes of the six or seven lower.
Rhomboideus Major – Spinous processes of the four or five upper.
Splenius – Spinous processes of the six upper.
Serratus Posticus Superior – Spinous processes of the two or three upper.
Serratus Posticus Inferior – Spinous processes of the two last.
Longissimus Dorsi – Tips of transverse processes of all.
Transversalis Colli – Tips of transverse processes of the four or five upper.
Trachelo-Mastoid – Transverse processes of the five upper.
Spinalis Dorsi – Spinous processes of from four to eight of the middle & upper.
Multifidus Spinæ – Tips of transverse & spinous processes of all.
Semispinales Dorsi – Transverse prs. from the 10th to the 5th, spinous prs. of the four upper.
Semispinales Colli – Transverse processes of the four upper.
Rotatores Spinæ – Upper & back part of transverse prs. of the eleven lower, lower margin & posterior surface of laminæ and roots of spinous prs. of the eleven upper.
Complexus – Transverse processes of the four or five upper.
Biventer Cervicis – Transverse processes of the two, three, or four upper.
Spinalis Colli – Spinous processes of the one or two upper.
Levatores Costarum or Supracostales – Tips of transverse processes of the eleven upper.
Interspinales – Sometimes to two or three of the upper and lower spinous processes.
Intertransversales – Upper & lower borders of a few of the lower transverse processes.
Psoas Magnus – Side of body of last.
Psoas Parvus – Side of body of last.
Longus Colli (*Inferior Oblique & Vertical Portions*) – Front of bodies of the two or three upper.

LUMBAR VERTEBRÆ — Are fourteen in number, and are attached as follows: -
The Diaphragm – (*Right Crus*) – Front of bodies of 1st, 2nd, & 3rd, or sometimes of 2nd, 3rd & 4th.
(*Left Crus*) – Left side of bodies of 1st & 2nd, or sometimes of 2nd & 3rd.
Psoas Magnus – Sides of bodies and bases of transverse processes of all.
Psoas Parvus – Side of body of first.
Internal Oblique – Tips of spinous processes of all (by posterior layer of lumbar fascia).
Transversalis – Tips of spinous processes, tips & bases of transverse processes of all (by lumbar fascia).
Quadratus Lumborum (*Anterior Portion*) – Upper border of transverse processes of the two or three lower.
(*Posterior Portion*) – Apices of the transverse prs. of the four upper.
Latissimus Dorsi – Spinous processes of all.
Serratus Posticus Inferior – Spinous processes of the two or three upper.
Erector Spinæ – Spinous processes of all.
Longissimus Dorsi (*Inner Series of Insertions*) – Tubercles (mammillary) on back of superior articular processes.
(*Outer Series of Insertions*) – Posterior surfaces of transverse processes.
Multifidus Spinæ – Tubercles (mammillary) on back of superior articular processes, spinous processes and adjoining portion of the laminæ of all.
Spinalis Dorsi – Spinous processes of the two first.
Interspinales – Spinous processes of all.
Intertransversales – Transverse processes of all.

SACRUM – Are six in number, and are attached as follows: -
Erector Spinæ – Spinous processes and series of eminences on back of sacrum, which eminences represent the articular and transverse processes of the vertebræ.
Multifidus Spinæ – Sacral groove.
Gluteus Maximus – Post. surf. (by a tendinous expansion) & lower part of lateral border.
Coccygeus – Side of lower piece.
Pyriformis – Anterior surface between 1st, 2nd, 3rd, & 4th anterior sacral foramina, & grooves leading from them.
Iliacus – Portion of base which forms part of iliac fossa.

COCCYX — Are four in number, and are attached as follows: -
Sphincter Ani – Tip.
Coccygeus – } Side.
Levator Ani – }
Gluteus Maximus – Side and back.

MUSCLES ATTACHED to BONES of UPPER LIMB—1st T.

The muscles attached to the

CLAVICLE — Are six in number, and are attached as follows: –

Sterno-Cleido-Mastoid – Anterior surface & upper border of inner third.
Pectoralis Major – Anterior surface & anterior border of inner half.
Deltoid – Upper surface & anterior border of outer half.
Trapezius – Upper surface & posterior border of outer third.
Subclavius – Groove on under surface of middle third.
Sterno-Cleido-Hyoid – Sometimes, from back of inner extremity.

SCAPULA — Seventeen in number, and are attached as follows: –

Supraspinatus – Inner two-thirds of supraspinous fossa.
Infraspinatus – Inner two-thirds of infraspinous fossa & ridges on its surface.
Teres Major – Posterior aspect of inferior angle.
Teres Minor – Upper two-thirds of posterior aspect of axillary border.
Deltoid – Upper surface & outer border of acromion, whole length of lower lip posterior border of spin
Trapezius – Upper surface and inner border of acromion, whole length of upper lip posterior border of spin
Subscapularis – Inner two-thirds of subscapular fossa & ridges on its surface.
Serratus Magnus – Whole length of anterior lip of posterior border.
Rhomboideus Major – Posterior border between spine & inferior angle.
Rhomboideus Minor – Posterior border opposite triangular smooth surface at root of spine.
Levator Anguli Scapulæ – Posterior border between spine & superior angle.
Omo-Hyoid – Upper border on inner side of suprascapular notch.
Long Head of Triceps – Rough triangular depression below glenoid cavity.
Pectoralis Minor – Inner border of coracoid process.
Coraco-Brachialis }
Short Head of Biceps } – Tip of coracoid process.
Long Head of Biceps – Top of glenoid cavity.
Latissimus Dorsi – Sometimes, from back of inferior angle.

MUSCLES ATTACHED to BONES of UPPER LIMB–2nd T.

The muscles attached to the

HUMERUS — Are twenty-four in number, and are attached as follows: –

Supraspinatus – Highest of the three facets on greater tuberosity.
Infraspinatus – Middle facet on greater tuberosity.
Teres Minor – Lowest facet on greater tuberosity, and by a few fleshy fibres into the neck for a short distance lower down.
Subscapularis – Lesser tuberosity, and by a few fleshy fibres into the neck for a short distance lower down.
Teres Major – Inner or posterior edge of bicipital groove.
Pectoralis Major – Anterior or outer edge of bicipital groove.
Latissimus Dorsi – Bottom of bicipital groove.
Deltoid – Rough triangular prominence a little above middle of outer surface of shaft.
Coraco-Brachialis – Rough impression a little above middle of inner surface of shaft.
Brachialis Anticus – Lower half of inner & outer surfaces of shaft.
Inner & Outer Heads of Triceps –
  Inner head – Posterior surface of shaft below musculo-spiral groove, inner border.
  Outer head – Posterior surface of shaft above musculo-spiral groove, outer border.
Supinator Longus – Upper two-thirds of external condyloid ridge.
Extensor Carpi Radialis Longior – Lower third of external condyloid ridge.
Extensor Carpi Radialis Brevior – External condyle.
Extensor Communis Digitorum – „
Extensor Minimi Digiti – „
Extensor Carpi Ulnaris – „
Anconeus – „
Supinator Brevis – „
Pronator Radii Teres (Inner Head) – Inner condyle & internal condyloid ridge im

Flexor Carpi Radialis – Inner condyle.
Palmaris Longus – „
Flexor Carpi Ulnaris (Anterior or Outer Head) – Inner condyle.
Flexor Sublimis Digitorum (Inner Head) – „

MUSCLES ATTACHED to BONES of UPPER LIMB—3rd T

The muscles attached to the

RADIUS — Are nine in number, and are attached as follows: –

Biceps – Back part of bicipital tuberosity.
Supinator Brevis – Inner, anterior & outer aspects of the bone above bicipital tuberosit & oblique line as low down as insertion of pronator radii tere
Flexor Sublimis Digitorum (Outer Head) – Oblique line.
Pronator Radii Teres – Rough impression on middle of outer surface of shaft.
Flexor Longus Pollicis – Upper two-thirds of anterior surface of shaft.
Pronator Quadratus – Lower fourth of anterior surface & outer border.
Extensor Ossis Metacarpi Pollicis – Middle third of posterior surface of shaft.
Extensor Primi Internodii Pollicis – Posterior surface of shaft below foregoing.
Supinator Longus – Outer side of base of styloid process.

ULNA — Are thirteen in number, and are attached as follows: –

Supinator Brevis – Triangular depression below lesser sigmoid cavity & ridge behind t depressi
Brachialis Anticus – Under surface of coronoid process.
Flexor Sublimis Digitorum (Middle Head) – Tubercle on inner surface of coronoid proc above pronator radii ter
Pronator Radii Teres (Outer Head) – Ridge on inner surface of coronoid process bel flexor sublim
Flexor Profundus Digitorum – Depression on inner surface of coronoid process, upper tw thirds of anterior & inner surfaces, and, by an aponeurosis which is comm to it & to flexor carpi ulnaris, upper two-thirds of posterior bord
Flexor Carpi Ulnaris (Posterior Head) – Inner border of olecranon, and by an aponeur which is common to it & to flexor profundus, upper two-thirds of posterior bord
Triceps –Back part of upper surface of olecranon.
Anconeus – Rough triangular surface on outer side of olecranon & upper third of shaft.
Pronator Quadratus – Lower fourth of anterior surface & inner border.
Extensor Carpi Ulnaris – Middle third of posterior border. Usually it simply cov but sometimes it arises from, narrow portion of posterior surface internal to vertical ri
Extensor Ossis Metacarpi Pollicis – Outer half of posterior surface below insertion of ancon
Extensor Secundi Internodii Pollicis – Middle of outer half of posterior surface.
Extensor Indicis – Posterior surface below foregoing.

MUSCLES ATTACHED to BONES of UPPER LIMB—4th T.

The muscular attachments of the

BONES of the HAND & WRIST — Are as follows: -

Pisiform - Two muscles:
Flexor Carpi Ulnaris.
Abductor Minimi Digiti, or Pisi-Phalangeal.

Trapezium - Three muscles:
Abductor Pollicis, or Trapezo-Phalangeal - Ridge on anterior surface.
Opponens Pollicis, or Trapezo-Metacarpal - Front of the bone below the ridge.
Flexor Brevis Pollicis, or Trapezo-Carpo-Phalangeal (Outer Head) - Lower part of the bone.

Trapezoides - One muscle:
Flexor Brevis Pollicis or Trapezo-Carpo-Phalangeal (Outer Head).

Os Magnum - One muscle:
Flexor Brevis Pollicis, or Trapezo-Carpo-Phalangeal (Outer Head).

Os Unciform - Two muscles:
Flexor Brevis Minimi Digiti, or Unci-Phalangeal - Uniform process.
Opponens or Adductor Minimi Digiti, or Unci-Metacarpal - Unciform process.

First Metacarpal Bone - Three muscles:
Opponens Pollicis or Trapezo-Metacarpal - Whole length of outer border.
Extensor Ossis Metacarpi Pollicis - Back of base.
First Dorsal Interosseous Muscle, or Abductor Indicis - Back of outer side of shaft.

Second Metacarpal Bone - Six muscles:
Flexor Carpi Radialis - Front of base.
Extensor Carpi Radialis Longior - Back of base.
Flexor Brevis Pollicis, or Trapezo-Carpo-Phalangeal (Inner Head) - Lower part of front of base.
First Palmar Interosseous - Anterior or palmar half of inner surface of shaft.
First Dorsal Interosseous - Whole of outer surface of shaft.
Second Dorsal Interosseous - Posterior or dorsal half of inner surface of shaft.

Third metacarpal Bone - Six muscles:
Flexor Carpi Radialis - Front of base.
Extensor Carpi Radialis Brevior - Back of base.
Flexor Brevis Pollicis, or Trapezo-Carpo-Phalangeal (Inner Head) - Lower part of front of base.
Adductor Pollicis, or Metacarpo-Phalangeal - Lower two-thirds of anterior surface of shaft.
Second Dorsal Interosseous - Whole of outer surface of shaft.
Third Dorsal Interosseous - Whole of inner surface of shaft,

Fourth Metacarpal Bone - Three muscles:
Second Palmar Interosseous - Anterior or palmar half of outer surface of shaft.
Third Dorsal Interosseous - Posterior or dorsal half of outer surface of shaft.
Fourth Dorsal Interosseous - Whole of inner surface of shaft.

Fifth Metarcarpal Bone - Five muscles:
Flexor Carpi Ulnaris - Front of base,
Extensor Carpi Ulnaris - Back of base.
Adductor or Opponens Minimi Digiti, or Unci-Metacarpal - Whole length of inner border of shaft.
Third Palmar Interosseous - Anterior or palmar half of outer surface of shaft.
Fourth Dorsal Interosseous - Posterior or dorsal half of outer surface of shaft.

First Phalanx of Thumb - Four muscles:
Abductor Pollicis or Trapezo-Phalangeal - Outer side of base.
Flexor Brevis Pollicis or Trapezo-Carpo-Phalangeal - Either side of base, a sesamoid bone being developed in each tendon.
Adductor Pollicis or Metacarpo-Phalangeal - Inner side of base.
Extensor Primi Internodii Pollicis - Back of base.

First Phalanx of Index Finger - Two muscles.
First Dorsal Interosseous - Outer side of base.
First Palmar Interosseous - Inner side of base.

First Phalanx of Middle Finger - Two muscles:
Second Dorsal Interosseous - Outer side of base.
Third Dorsal Interosseous - Inner side of base..

First Phalanx of Ring Finger - Two muscles:
Second Palmar Interosseous - Outer side of base.
Fourth Dorsal Interosseous - Inner side of base.

First Phalanx of Little Finger - Three muscles:
Abductor Minimi Digiti or Pisi-Phalangeal - Inner side of base.
Flexor Brevis Minimi Digiti or Unci-Phalangeal - Inner side of base.
Third Palmar Interosseous - Inner side of base.

Second Phalanx of Thumb - Two muscles;
Flexor Longus Pollicis - Front of base.
Extensor Secundi Internodii Pollicis - Back of base.

Second Phalanges of Four Inner Fingers - Two muscles each:
Flexor Sublimis Digitorum - A slip to either side of shaft.
Extensor Communis Digitorum (Middle slip) - Back of Base.

Third Phalanges - Two muscles each:
Flexor Profundus Digitorum - Front of base.
Extensor Communis Digitorum (Both lateral slips) - Back of base.

MUSCLES ATTACHED to BONES of LOWER LIMB—1st T

The muscles attached to the

INNOMINATE BONE — Are thirty-two in number, and are attached as follows:–

Ilium – Thirteen:–

Gluteus Maximus – Superior curved line on dorsum ilii and rough surface between & posterior fifth of cres
Gluteus Medius – Dorsum ilii & outer lip of crest between superior & middle curved line
Gluteus Minimus – Dorsum ilii between middle & inferior curved lines.
Rectus Femoris (Reflected Tendon) – Groove above brim of acetabulum.
(Straight Tendon) – Anterior inferior spine.
Iliacus – Iliac fossa & inner lip of crest.
Sartorius – Anterior superior spine & upper half of notch below it.
Tensor Vaginæ Femoris – Anterior superior spine & anterior fifth of outer lip of cres
Obliquus Externus – Anterior half of outer lip of crest.
Latissimus Dorsi – Posterior half of outer lip of crest.
Internal Oblique – Anterior two-thirds of middle lip of crest.
Transversalis – Anterior three-fourths of inner lip of crest.
Quadratus Lumborum – Posterior part of inner lip of crest for about two or three inch in front of erector spin
Erector Spinæ – Posterior superior spine & posterior fifth of inner lip of crest.

Ischium – Fourteen:–

Gracilis – Inner margin of ascending ramus.
Adductor Magnus – Ascending ramus & outer side of tuberosity.
Obturator Externus – Circumference of obturator foramen.
Transversus Perinæi – Inner & fore part of tuberosity.
Erector Penis or Clitoridis – Pubic arch & fore part of inner side of tuberosity.
Obturator Internus – Whole of inner surface of true pelvis in front of and behind turator foram
Gemellus Superior
Levator Ani } – Spine.
Coccygeus
Gemellus Inferior – Upper part of outer lip of tuberosity.
Quadratus Femoris – Whole length of outer lip of tuberosity.
Biceps (Long Head) – Lower & inner of the two surfaces on back part of tuberosity
Semitendinosus – Lower & inner of the two surfaces on back part of tuberosity.
Semimembranosus – Upper & outer of the two surfaces on back part of tuberosity.

Pubes – Twelve:–

Pectineus – Ilio-pectineal line & surface in front of it.
Adductor Longus – Front of body immediately below the crest & close to angle.
Adductor Brevis – Front of body for about two inches below adductor longus & betw gracilis & obturator exter
Adductor Magnus – Lower part of descending ramus.
Gracilis – Inner margin of ramus & lower half of inner margin of body.
Obturator Externus – Circumference of obturator foramen.
Obturator Internus – Whole of inner surface of true pelvis in front of & behind turator foram
Rectus abdominis
Pyramidalis } – Crest.
Conjoined Tend. of Int. Oblique & Transv.
Levator Ani – Back of body.

MUSCLES ATTACHED to BONES of LOWER LIMB—2nd T.

The muscles attached to the

FEMUR — Are twenty-four in number, and are attached as follows: -

Vastus Externus – Anterior border of great trochanter & horizontal ridge on its outer surface; rough line from great trochanter to linea aspera; whole length of outer lip of linea aspera and line from linea aspera to outer condyle.

Vastus Internus – Line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; inner surface.

Crureus – Anterior & outer surfaces from anterior intertrochanteric line to within a few inches of condyles.

Taking the vastus internus & the crureus as forming but one muscle, and describing the *Quadriceps extensor femoris* as a *Triceps*, we may say that the "VASTUS INTERNUS" arises from: – line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; nearly whole of *inner*, *anterior* and *outer* surfaces of shaft of femur.

Subcrureus – Lower part of anterior surface.

Psoas Magnus – Lesser trochanter.

Iliacus – Upper part of line from trochanter minor to linea aspera in front of pectineus.

Pectineus – Upper part of line from trochanter minor to linea aspera, & into the bone behind trochanter minor.

Adductor Longus – Middle third of inner lip of linea aspera between vastus internus & adductor magnus.

Adductor Brevis – Upper part of linea aspera & lower part of line from it to lesser trochanter below & behind pectineus.

Adductor Magnus – Lower part of line from great trochanter to linea aspera, whole length of inner lip of linea aspera & line from it to inner condyle; by a strong tendon into tubercle at upper & back part of inner condyle.

Biceps (Short Head) – Whole length of outer lip of linea aspera between adductor magnus & vastus externus, and from inferior external division of linea aspera to within two inches of outer condyle.

Gluteus Maximus – Rough line from great trochanter to linea aspera.

Gluteus Medius – Oblique line on outer surface of great trochanter.

Gluteus Minimus – Anterior border of great trochanter.

Pyriformis – Posterior part of upper border of great trochanter.

Obturator Internus – Upper border of great trochanter in front of pyriformis.

Gemellus Superior. }
Gemellus Inferior. } Indirectly, by joining tendon of foregoing.

Quadratus Femoris – Upper part of linea quadrati on back of great trochanter.

Obturator Externus – Digital fossa.

Gastrocnemius – Depressions at upper and back part of condyles, and lower part of the two inferior divisions of linea aspera.

Plantaris – Lower part of outer division of linea aspera.

Popliteus – Anterior & deepest part of groove on outer side of outer condyle of femur below tubercle for external lateral ligament of knee-joint.

Semimembranosus – Posterior & upper part of outer condyle.

MUSCLES ATTACHED to BONES of LOWER LIMB—3rd T.

The muscles attached to the

TIBIA — Are ten in number, and are attached as follows: –

Tibialis Anticus – Outer tuberosity & upper two-thirds of outer surface of shaft
Extensor Longus Digitorum – Outer tuberosity.
Sartorius – Upper part of inner surface of shaft covering tendons of gracilis & semitendinosus.
Gracilis – Upper part of inner surface of shaft above semitendinosus, and beneath sartorius.
Semitendinosus – Upper part of inner surface of shaft below gracilis & beneath sartorius.
Semimembranosus – Posterior part of inner tuberosity; groove on inner side of inner tuberosity.
Popliteus – Inner two-thirds of triangular surface on back of upper part of shaft.
Soleus – Middle third of inner border, and oblique line on posterior surface of shaft.
Flexor Longus Digitorum – Posterior surface of shaft below oblique line & internally t attachment of tibialis posticus
Tibialis Posticus – Posterior surface of shaft below oblique line & externally to attachment of flexor longus digitorum

FIBULA — Are nine in number, and are attached as follows: –

Extensor Longus Digitorum – Upper three-fourths of anterior surface of shaft.
Extensor Proprius Pollicis – Middle two-fourths of anterior surface of shaft internally to extensor longus digitorum
Peroneus Tertius – Lower fourth of anterior surface of shaft.
Peroneus Longus – Head & upper two-thirds of outer surface & of anterior & posterior borders
Peroneus Brevis – Lower two-thirds of outer surface of shaft, passing upwards in a pointe process beneath peroneus longus
Biceps – Outer side of head.
Soleus – Back of head & upper third of posterior surface of shaft.
Flexor Longus Pollicis – Lower two-thirds of posterior surface of shaft.
Tibialis Posticus – Upper three-fourths of inner surface of shaft.

MUSCLES ATTACHED to BONES of LOWER LIMB—4th T.

- **Os Calcis** - Eight muscles:
  - *Gastrocnemius, Plantaris, Soleus* - Lower part of posterior surface.
  - *Extensor Brevis Digitorum* - Upper and outer surfaces of greater process.
  - *Flexor Brevis Digitorum* - Greater tuberosity.
  - *Abductor Pollicis* - Greater tuberosity internally to foregoing.
  - *Abductor Minimi Digiti* - Lesser tuberosity, greater tuberosity in front of flexor brevis.
  - *Flexor Accessorius* - Inner & under surfaces in front of tuberosities.
- **Scaphoid** - One muscle:
  - *Tibialis Posticus* - Tuberosity.
- **Cuboid** - One muscle:
  - *Flexor Brevis Pollicis* - Inner part of under surface.
- **Internal Cuneiform Bone** - Two muscles:
  - *Tibialis Anticus* - Front part of inner & under surfaces.
  - *Tibialis Posticus* - Back part of under surface.
- **External Cuneiform Bone** - Two muscles:
  - *Tibialis Posticus* - Under surface.
  - *Flexor Brevis Pollicis* - ,,
- **First Metatarsal Bone** - Three muscles:
  - *Tibialis Anticus* - Inner side of base.
  - *Peroneus Longus* - Outer side of base.
  - *First Dorsal Interosseous* - Upper or dorsal half of outer surface of shaft.
- **Second Metatarsal bone** - Three muscles:
  - *First Dorsal Interosseous* - Whole of inner surface of shaft.
  - *Second Dorsal Interosseous* - Whole of outer surface of shaft.
  - *Adductor Pollicis* - Under surface of base.
- **Third Metatarsal Bone** - Four Muscles:
  - *First Plantar Interosseous* - Lower or plantar half of inner surface of shaft.
  - *Second Dorsal Interosseous* - Upper or dorsal half of inner surface of shaft.
  - *Third Dorsal Interosseous* - Whole of outer surface of shaft.
  - *Adductor Pollicis* - Under surface of base.
- **Fourth Metatarsal Bone** - Four muscles:
  - *Third Dorsal Interosseous* - Upper or dorsal half of inner surface of shaft.
  - *Second Plantar Interosseous* - Lower or plantar half of inner surface of shaft.
  - *Fourth Dorsal Interosseous* - Whole of outer surface of shaft.
  - *Adductor Pollicis* - Under surface of base.
- **Fifth Metatarsal Bone** - Six muscles:
  - *Peroneus Brevis* - Outer side of base.
  - *Peroneus Tertius* - Upper surface of base.
  - *Flexor Brevis Minimi Digiti* - Under surface of base.
  - *Transversus Pedis* - Under surface of head.
  - *Fourth Dorsal Interosseous* - Upper or dorsal half of inner surface of shaft.
  - *Third Plantar Interosseous* - Lower or plantar half of inner surface of shaft.
- **First Phalanx of Great Toe** - Five muscles:
  - *Abductor Pollicis* - Inner side of base.
  - *Flexor Brevis Pollicis* - Inner & outer sides of base
  - *Adductor Pollicis* - Outer side of base.
  - *Transversus Pedis* - ,,
  - *Extensor Brevis Digitorum (Innermost Tendon)* - Outer side of base.
- **First Phalanx of 2nd Toe** - Three muscles:
  - *First Dorsal Interosseous* - Inner side of base.
  - *Second Dorsal Interosseous* - Outer side of base.
  - *First Lumbricalis* - Inner side of base.
- **First Phalanx of 3rd Toe** - Three muscles:
  - *Third Dorsal Interosseous* - Outer side of base.
  - *First Plantar Interosseous* - Inner side of base.
  - *Second Lumbricalis* - Inner side of base.
- **First Phalanx of 4th Toe** - Three muscles:
  - *Fourth Dorsal Interosseous* - Outer side of base.
  - *Second Plantar Interosseous* - Inner side of base.
  - *Third Lumbricalis* - Inner side of base.
- **First Phalanx of 5th Toe** - Four muscles:
  - *Abductor Minimi Digiti* - Outer side of base.
  - *Flexor Brevis Minimi Digiti* - ,,
  - *Third Plantar Interosseous* - Inner side of base.
  - *Fourth Lumbricalis* - ,,
- **Second Phalanx of Great Toe** - Two muscles:
  - *Extensor Proprius Pollicis* - Upper surface of base.
  - *Flexor Longus Pollicis* - Under surface of base.
- **Second Phalanges of Four Outer Toes** - Two muscles:
  - *Extensor Longus Digitorum* - Upper surface of base.
  - *Flexor Brevis Digitorum* - Sides of shaft.
- **Third Phalanges of Four Outer Toes** - Two muscles:
  - *Extensor Longus Digitorum* - Upper surface of base.
  - *Flexor Longus Digitorum* - Under surface of base.

JOINTS AND LIGAMENTS.

THE CLASSIFICATION of JOINTS.

The joints may be divided into:

SYNARTHROSES — The bones are immoveably interlocked, and are in almost imme- diate contact, being separated only by a thin layer of periosteum termed the sutural ligament, and, at the base of the skull, by a thin layer of cartilage. – The varieties are the

Sutura Vera – The bones present a series of processes & indentations, which fit in with each other. The subvarieties are the

S. Dentata – The interlocking processes are large & ramified. – Ex.: *Sagittal & lamboid sutures*

S. Serrata – The interlocking processes are smaller & more regular. – Ex.: *Tem porary suture in middle line of frontal bone*

S. Limbosa – The articular surfaces are more or less bevelled, and one overlaps th other. – Ex.: *Fronto-parietal sutur*

Sutura Notha or False Suture – A mere apposition of rough surfaces. – Th subvarieties are the

S. Squamosa – Considerable overlapping of extensively bevelled surfaces. – Ex. *Temporo-parietal sutur*

S. Harmonica – Apposition in the mesial line of two symmetrical & vertically cu surfaces. – Ex.: *Articulation between the two halves of the upper jaw*

Schindylesis – A thin plate of bone is received into a cleft formed by the separatio of the two plates of another bone. – Ex.: *Articulation of the rostrum of the sphenoi with the vome*

Gomphosis – The implantation of the teeth into the alveolar processes.

AMPHIARTHROSES — The bones are bound together *almost* immoveably by means thick plates of fibro-cartilage extremely adherent to each bone, and by stron external ligaments. In some cases the articular surfaces are partly covered b a thin layer of cartilage, and are partly lined with synovial membrane. Th one class of amphiarthroses resemble the synarthroses, the other class resembl the diarthrose

DIARTHROSES — The bones are bound together by means of external ligaments line with synovial membrane, and the articular surfaces are covered with cartilag Plates or rings of fibro-cartilage are sometimes included within the articul cavity, which cavity they occasionally divide into two distinct parts. – Th arthrodiæ having recently been subdivided by Cruveilhier into arthrodiæ prope condyloid articulations, & articulations by reciprocal reception, the varieties the diarthroses may now be enumerated as follows (in the order of decreasi variety & decreasing extent of the movements they admit) – :

Enarthroses – Globular head received into a cup-shaped cavity. Well defined caps lar ligament. The movements are flexion, extension, adduction, abductio circumduction, & rotation. – Ex: *Hip-joi*

Articulations by Reciprocal Reception – Articular surfaces inversely convex one direction & concave in the other. Capsular ligament less perfect & comple than in the enarthroses. The movements are flexion, extension, adduction, a duction, & circumduction; there is no of axial rotation. – Ex: *Articulation of t metacarpal bone of the thumb with the trapeziu*

Condyloid Articulations – Ovoid articular head, or condyle, received into elliptical cavity. Strong anterior, posterior & lateral ligaments. Flexion & e tension very free; adduction, abduction & circumduction, rather less so; axial rotation. Ex: *Wrist-joi*

Ginglymi – Trochlear surface on the one hand, cavity of reception to correspond, the other. Strong lateral ligaments; anterior & posterior ligaments l slightly marked. Flexion & extension only. Ex: *Elbow-joi*

Diarthroses Rotatorii – Pivot-like process turning in an osteo-fibrous ring, osteo-fibrous ring rotating upon an axial process. Rotatory movements on Ex: *Superior & inferior radio-ulnar articulatio*

Arthrodiæ Proper – Articular surfaces flat or nearly so. Thin & loose capsul Only gliding movements, which movements are never very extensive. I *Acromio-clavicular articulat*

TEMPORO-MAXILLARY ARTICULATION

Is a double or bilateral condyloid articulation (Cruveilhier) comprised between the condyles of the lower jaw, on the one hand, and the anterior root of the zygoma & anterior part of the glenoid cavity, on the other. The articulation is divided into two by an interarticular fibrocartilage, and presents two synovial membranes, of which the upper one is the largest & loosest. The interarticular fibrocartilage is thickest at the periphery, especially behind; its upper surface is concavo-convex from before backwards; its under surface is concave; its circumference is connected externally to the external lateral ligament, internally & in front to the tendon of the external pterygoid. – Occasionally it is perforated in the centre, the two synovial membranes then communicating.

LIGAMENTS – Are :

Capsular – Thin & loose ; from
Circumference of glenoid cavity & eminentia articularis to
Neck of condyle.

External Lateral – Broad band downwards & backwards from
Outer surface & tubercle of zygoma to
Outer surface & posterior border of neck of condyle.

Internal Lateral – Long & thin band from
Spine of sphenoid to
Inner margin of dental foramen. – It is related externally to the external pterygoid muscle, internal maxillary artery, and inferior dental vessels & nerve.

Stylo-Maxillary – Long thin band of somewhat secondary importance from
Apex of styloid process to
Angle & posterior border of ramus of jaw, where it spreads out considerably and marks the separation between parotid & submaxillary glands.

MOVEMENTS – Are depression, elevation, projection, retraction, lateral displacement & circumduction. In slight movements of elevation & depression the condyles simply rotate on a transverse axis upon the interarticular fibrocartilages. In more extensive movements not only do the condyles rotate as above, but they also pass forwards with the interarticular fibrocartilages upon the eminentiæ articulares, the displacement being due to the laxity of the superior synovial membrane & to the action of the external lateral ligament. This displacement also takes place on the two sides alternately in the lateral or grinding movement of the jaw, and on both sides simultaneously in the projection of the jaw forwards.

ARTICULATIONS of the VERTEBRÆ.

The vertebræ are joined together by their bodies, articular processes, laminæ, spinous processe & transverse processe

BODIES — Form a series of amphiarthrodial articulations, and are joined together by: –

Intervertebral Discs – Lenticular discs of fibro-cartilage firmly adherent to the *Thin plates of cartilage, which cover upper & under surfaces of bodies of adjoining vertebr*

They increase in thickness from above downwards, and form collectivel about one-fourth of the length of the spine. They are thickest in front in the cer vical & lumbar regions, behind in the dorsal region. Their cicumference i closely connected in front & behind to the anterior & posterior common ligaments laterally they form part, in the dorsal region, of the articular cavities for th heads of the ribs, and give attachment to the interarticular costo-vertebral lig ments. – Their central part consists of a soft pulpy mass, which is a remnant the chorda dorsalis, and in which a small synovial cavity is found (Lushka Their outer half or more consists of alternate concentric laminæ of fibrous tiss & of cartilage, of which laminæ the more superficial ones tend to bulge outward and the deeper ones to bulge inwards; the strands of the fibrous laminæ a mainly oblique, and are inclined so as to cross each other in the adjacent lamin

Anterior Common Ligament – Broad & strong band covering front of bodies, and e tending fro

Front of body of axis to

Prominent margins of bodies of vertebræ & intervertebral discs down to sacrum.

Thickest in dorsal region, in median line, & opposite middle or conca part of the bodies. Its deepest fibres are short, and extend from one vertebra the adjoining one; its intermediate fibres extend over two or three vertebræ; i superficial ones over four or fiv

Posterior Common Ligament – Strong band, thicker but narrower than foregoing, e tending fro

Back of body of axis, where it is continuous with occipito-axoid ligament, to

Intervertebral discs & margins of the vertebræ down to the sacrum.

Broadest in the neck, where it covers almost entirely the bodies of the vert bræ, but, in the dorsal & lumbar regions, broad at its points of attachment on and narrow opposite the centre of the bodies. Separated from central part bodies by the venæ basis vertebræ, and from the dura mater of the cord, by little loose connective tissue. Consists, as foregoing, of long superficial & of sh deep fibr

ARTICULAR PROCESSES — Form a series of arthrodial articulations, and are joined gether

Capsular Ligaments – Thin, irregular, looser in the cervical than in the dorsal & lum regions. Connect

Contiguous margins of the articular processes, – of which processes the superior ones lo backwards & upwards in the cervical region, backwards & outwards in the dors backwards & inwards in the lumbar, where they are concave & farther ap than the inferior on

LAMINÆ — Are joined together by the

Ligamenta Subflava – Highly elastic bands placed, one on each side, between the a joining laminæ, and extending fr

Anterior surface & lower border of lamina above to

Posterior surface & upper border of lamina below.

They are made up of nearly vertical bands of yellow elastic fibrous tissue, a are best seen from interior of spinal canal. They are thin, broad & long in cervical region, thicker, shorter & narrower in the dorsal region, thickest narrowest in the lumb

SPINOUS PROCESSES — Are joined together by:

Interspinous Ligaments – Most developed in lumbar region, least in cervical. Conn

Adjacent margins of adjoining spines.

Supraspinous Ligament – Strong fibrous cord intimately blended with neighbouri aponeuroses, and thickest in lumbar region. Conne

Apices of spines from 7th cervical to sacrum.

It consists of long superficial & of short deep fibres, and is continued upwa by the *ligamentum nuchæ* to the external occipital protuberance & to the spines the six upper cervical vertebræ; the ligamentum nuchæ is however relatively t in man, in whom it is reduced to a kind of intermuscular sept

TRANSVERSE PROCESSES — Are joined together by the

Intertransverse Ligaments – Most developed in the dorsal region, where they f short rounded cords connected with the deep muscles of the back. Thin & me branous in the lumbar region. Insignificant or wanting in the cervical regi Con

Adjacent margins of adjoining transverse processes.

N. — See next Tablet for articulations of the *two first* vertebræ.

RTICULATIONS of the CRANIUM with the SPINE

Are the *occipito-atloid* and *occipito-axoid* articulations, from which articulations the *atlo-axoid* articulation cannot well be separated.

OCCIPITO-ATLOID ARTICULATION — Consists of a double arthrodia between condyles of occipital and superior articular surfaces of atlas; the condyles being convex from before backwards & inwards and looking downwards & outwards, and the articular surfaces of the atlas being concave from before backwards & inwards and looking upwards & inwards. The ligaments are: –

Capsular – Two. Thin & loose; surround the arthrodial articulations. The synovial membranes of these articulations often communicate with that of the syndesmo-odontoid articulation.

Ant. Occipito-Atloid – Two:

Superficial – Strong rounded cord from
Basilar process to – *Anterior tubercle of atlas.*

Deep – Thin & broad membrane from
Anterior margin of foramen magnum to – *Upper border of anterior arch of atlas.*

Post. Occipito-Atloid – Thin & broad membrane from
Posterior margin of foramen magnum to – *Upper border of posterior arch of atlas.* It is perforated on either side by vertebral artery & suboccipital n.

Lateral Occipito-Atloid – Two. Strong bands from
Jugular process to – *Base of transverse process of atlas.*

OCCIPITO-AXOID ARTICULATION — No direct contact between the two bones, but the two bones are firmly connected together, nevertheless, by the following ligts: –

Occipito-Axoid – Strong broad band expanded superiorly, and which may be considered as a continuation upwards of the posterior common ligament of the bodies of the vertebræ; from *Basilar groove of occipital,* where it becomes continuous with dura mater of skull, to – *Posterior surface of body of axis.* – It covers and conceals the cruciform ligament.

Occipito-Odontoid – Three, two lateral & one median.

Lateral Occipito-Odontoid or Check Ligaments – Strong rounded cords from
Rough depression on inner side of condyles of occipital to – *Sides of odontoid pr. near its apex.*

Median or Suspensory Occipito-Odontoid Ligament – Strong band from
Anterior margin of foramen magnum to – *Apex of odontoid process.* – This band is situated between, & blended superiorly, with deep anterior occipito-atloid ligt., on the one hand, & upper fasciculus of cruciform ligt. on the other.

Vertical Fasciculus of Cruciform Ligt. – V. below.

ATLO-AXOID ARTICULATION — Is a complex articulation consisting: 1. of a double arthrodia between the articular processes, the articular surfaces of which are large, flat, circular, and inclined downwards & outwards. 2. of a double diarthrosis rotatorius between the anterior & posterior surfaces of the odontoid process, on the one hand, and the posterior & anterior surfaces respectively of the anterior arch of the atlas & of the transverse ligament, on the other hand, (atlo-odontoid & syndesmo-odontoid articulations, Cruveilhier). The ligaments are: –

Capsular – Two. Thin, loose, strongest externally; surround the two arthrodiæ.

Ant. Atlo-Axoid – Two:

Superficial – Strong rounded cord from
Anterior tubercle of atlas to – *Base of odontoid proccess & front of body of axis.*

Deep – Thin & broad membrane from
Lower border of anterior arch of atlas to – *Base of odontoid process & front of body of axis.*

Post. Atlo-Axoid – Thin & broad membrane from
Lower border of posterior arch of atlas to – *Upper border of laminæ of axis.*

Transverse – Strong transverse band, broadest in middle, which divides ring of atlas into a small anterior part, in which anterior part the neck of the odontoid process is firmly constricted, and a much larger posterior part, which transmits the cord & its membranes & the spinal accessory nerves. It is attached on each side to a *Tubercle on inner surface of lateral mass of atlas* – Its anterior surface is lined with synovial membrane of syndesmo-odontoid articulation. From its upper & lower borders, or rather from its posterior surface, are given off two fasciculi, which pass upwards & downwards to be attached, the one to the *basilar groove,* the other to *posterior surface of body of axis;* with the transverse band, these vertical fasciculi form the *cruciform ligament.* The synovial membrane of the syndesmo-odontoid articulation often communicates with one or both of those of the occipito-atloid arthrodiæ.

ARTICULATIONS of the RIBS

Are four arthrodiæ, the *costo-vertebral, costo-transverse, chondro-sternal, & chondro-chondral,* of whic arthrodiæ the first is a double one, while the two last ones are frequently more or le imperfect & deficient in synovial membranes. – To the above articulations must be added tl *chondro-costal* articulations, which may be considered as diminutive synarthrose

COSTO-VERTEBRAL ARTICULATIONS — Are double arthrodiæ between the head of the ribs & the bodies of two adjoining vertebræ; the 1st, 11th, & 12th are, howevei single arthrodiæ, since the corresponding ribs articulate with one vertebra only. The ligaments are

Capsular – Thin; surrounds articular surfaces.

Ant. Costo-Vertebral – Forms three fasciculi from
Front of head of rib to – *Bodies of vertebræ above & below and to intervertebral disc.*

Interarticular Costo-Vertebral – From
Crest on head of rib to – *Intervertebral disc,* dividing articular cavity into two.
In the 1st, 11th, & 12th costo-vertebral articulations there is no intera ticular ligament, and the anterior ligament is attached only to the vert bra abov

COSTO-TRANSVERSE ARTICULATIONS — Are ten arthrodial articulations betwe the tubercles of the ten upper ribs & the transverse processes of the lower of the tv vertebræ, with which the head of the corresponding rib articulates. –The ligaments ar

Post. or Ext. Costo-Transverse – From
Apex of transverse process to – *Rough outer part of tubercle of rib.*

Middle or Interosseous Costo-Transverse – Formed of short fibres from
Front of transverse process to – *Back of neck of rib.*

Ant., Sup., or Long Costo-Transverse – From
Upper border of neck of rib to – *Lower border of transverse process of the vertebra abo*
The 11th & 12th ribs are connected to the corresponding transver process by a thin & ill-developed *middle or interosseous ligament,* and to t transverse process of the vertebra above by a well developed *anterior superior ligament* (Cruveilhier). – There is no anterior or superior ligame connected with the 1st ri

CHONDRO-STERNAL ARTICULATIONS — Connect the extremities of the seven fi costal cartilages to the margins of the sternum. The first chondro-sternal articul tion may be considered as a synarthrosis; it presents no synovial membrane. The others are arthrodiæ; these arthrodiæ are all single arthrodiæ (Gray), except t second & third, which latter are divided into two by interarticular ligaments; in ea life, however, according to Quain, they are all of them, usually, double arthrod excepting the 7th. In advanced age all the synovial membranes disappear, and t cartilages join with the sternum. – The ligaments a

Capsular – Thin, blended with anterior & posterior ligaments.

Ant. Chondro-Sternal – The thickest, radiates from
Front of costal cartilage to – *Front of sternum.*

Post. Chondro-Sternal – Thinner, radiates similarly from
Back of costal cartilage to – *Back of sternum.*

Chondro-Xiphoid – Thin band from
Front of xiphoid appendix to – *Front of 7th & sometimes of 6th cartilages.*

Interarticular – From
Crest of costal cartilage to – *Point of junction of primitive segments of sternum.* – Exi in the 2nd articulation only (Gray), in which it is attached to the cart age between manubrium & gladiolus; usually exists, in early life, in all t joints except the 1st & the 7th (Quai

CHONDRO-CHONDRAL ARTICULATIONS — Are four or five imperfect arthro which join the costal cartilages from the 5th or 6th to the 10th; the synovial me branes & the articular facets are often wanting, however, in the first articulation a in the one or two last. – The ligaments a

Capsular – Thin, strengthened by a few fibres termed

Intercostal, – Which latter extend from one cartilage to the other.

CHONDRO-COSTAL ARTICULATIONS — Outer extremity of each costal cartil is received into an oval depression on end of corresponding rib, and the rib & the c tilage are bound together by the blending of the periosteum & perichondri

RTICULATIONS of the PELVIS.

SACRO-ILIAC ARTICULATION or SYNCHONDROSIS

— Is an amphiarthrosis between contiguous surfaces of sacrum & ilium, the auricular portions of which surfaces are covered with plates of cartilage separated by a little soft pulpy tissue, and, in the pregnant female, by a small synovial cavity. The ligaments are the anterior & posterior sacro-iliac ligaments, from which the greater & lesser sacro-sciatic ligaments cannot well be separated.

Ant. Sacro-Iliac Ligament – Formed of thin irregular fibres which connect the
Anterior surfaces of the two bones.

Post. Sacro-Iliac Ligament – Consists of several strong & thick fibrous bands from
Posterior rough portion of lateral suface of sacrum to
Inner surface of that portion of ilium, which projects behind sacrum.
One superficial fasciculus termed the

Oblique Sacro-Iliac Ligament – Extends from
Posterior superior spine of ilium to
Back of third or fourth piece of sacrum.

Great or Post. Sacro-Sciatic Ligament – Strong triangular band expanded at both ends and attached by its base to
Posterior inferior spine or ilium, and posterior surface & margins of sacrum & coccyx, and by its apex to
Inner margin of tuberosity, and inner margin of ascending ramus of ischium.

Lesser or Ant. Sacro-Sciatic Ligament – Thinner triangular band attached by its base to
Margins of sacrum & coccyx in front of foregoing, and by its apex to
Spine of ischium. – It separates the greater & lesser sacro-sciatic foramina.

PUBIC ARTICULATION or SYMPHYSIS PUBIS

— Is an amphiarthrosis. The two oval articular surfaces are covered with plates of cartilage adhering firmly to the bones by means of small nipple-like processes which fit into corresponding depressions of the osseous surfaces. These plates are joined together by an interarticular fibro-cartilage thicker in front than behind, and in the centre of which, at its upper & back part, is usually found a small synovial cavity. – The ligaments are:

Ant. Pubic Ligament – Thick stratum of superficial oblique & deep transverse fibres.

Post. & Sup. Pubic Ligaments – Consist only of a few scattered fibres.

Inf. or Sub-Pubic Ligament – Strong fibrous arch attached to rami of pubes on either side.

SACRO-COCCYGEAL ARTICULATION

— Similar to articulations between bodies of vertebræ generally. – Presents:

Interarticular Fibro-Cartilage – Which sometimes contains a small synovial cavity.

Ant. Sacro-Coccygeal Ligament – From
Front of sacrum to
Front of coccyx.

Post. Sacro-Coccygeal Ligament – From
Margins of lower orifice of sacral canal to
Back of coccyx.

ARTICULATION of PELVIS with SPINE, or LUMBO-SACRAL or SACRO-VERTEBRAL ARTICULATION.

Similar to articulations between vertebræ generally, but has two additional ligaments, viz.,

Lumbo-Sacral or Sacro-Vertebral Ligament – Strong, triangular, fasciculus from
Lower and front part of transverse process of 5th lumbar vertebra to
Side of base of sacrum.

Lumbo-Iliac or Ilio-Lumbar Ligament – From
Tip of transverse process of 5th lumbar vertebra to
Back of crest of ilium.

STERNO-CLAVICULAR ARTICULATION

Is an articulation by reciprocal reception (Cruveilhier) between the clavicular facet of th sternum & the inner extremity of the clavicle, or rather, as is remarked by Gosselin, betwee the clavicular facet of the sternum & the inner surface of the interarticular fibro-cartilag Between these two latter articular surfaces there is a most perfect reciprocal adaptation: the sternal articular surface is concave from above downwards & outwards and convex fro before backwards ; the corresponding surface of the interarticular fibro-cartilage is concav from before backwards and convex from above downwards & outward

The interarticular fibro-cartilage divides the cavity of the articulation into two par lined each of them by a separate synovial membrane. The synovial membrane betwee the sternum & the interarticular fibro-cartilage is the largest & loosest; it is prolonge between the contiguous articular surfaces of the clavicle & of the first costal cartilage. The interarticular fibro-cartilage is thickest at its circumference, especially above & behind its inner surface, as aforesaid, is concave from before backwards & convex from above dowr wards & outwards. Its outer surface is concave, and is attached to the clavicle at its uppe & back part. Its circumference is attached to the capsular & to the anterior & posteric ligaments, and, inferiorly, to the cartilage of the first rib. – Occasionally the fibro-cartilag is perforated in the centre; the two synovial membranes then communicat

LIGAMENTS – Are:

Capsular – Thin & ill-defined, from
Circumference of inner extremity of clavicle to
Margin of sternal articular facet.

Ant. Sterno-Clavicular – Strong & broad oblique band from
Front of inner extremity of clavicle to
Upper & front part of first piece of sternum.

Post. Sterno-Clavicular – Thinner & narrower ; obliquely from
Back of inner extremity of clavicle to
Upper & back part of first piece of sternum.

Interclavicular – Thick flat band, which passes in a curved direction from
Upper part of inner extremity of one clavicle to
Upper part of inner extremity of other, being closely connected with the upp margin of the sternu

Costo-Clavicular or Rhomboid – Short flat cord from
Upper & inner part of cartilage of first rib to
Rhomboid impression on under surface of clavicle.

This ligament belongs, properly speaking, not to the sterno-clavicul but to the costo-clavicular articulation. It is usually describ here, however, as it contributes materially to retain the clavicle its situation. – The costo-clavicular articulation is, in fact, a pa of the sterno-clavicular, and the articulation of the inner extremi of the clavicle might well be called the *sterno-costo-clavicul*

MOVEMENTS — The sterno-clavicular or sterno-costo-clavicular articulation admits of mov ments in every direction, circumduction included, these moveme are not extensive, however, being limited, by the connexion of t clavicle with the scapula & the upper limb. – The interarticu fibro-cartilage moves with the inner extremity of the clavicle, glidi freely on the articular surface of the sternu

CROMIO-CLAVICULAR ARTICULATION

Is an arthrodial articulation.

ARTICULAR SURFACES — Are small, flat, elongated from before backwards, and oblique downwards & inwards.

LIGAMENTS:

Sup. Acromio-Clavicular – Strong broad band, from
Upper part of outer end of clavicle to
Adjoining part of upper surface of acromion.

Inf. Acromio-Clavicular – Similar to, but thinner than, preceding, from
Under part of outer end of clavicle to
Adjoining part of under surface of acromion.

Coraco-Clavicular – Does not properly form part of the articulation but is usually described with it, as it powerfully assists in retaining the clavicle in its normal position. Consists of two fasciculi, the

TRAPEZOID LIGAMENT – The most anterior & external, quadrilateral, from
Upper surface of coracoid process to
Oblique line on under surface of clavicle – Is joined to the following by its posterior border;

CONOID LIGAMENT – Posterior & internal to foregoing, and conical with base upwards, from
Base of coracoid process to
Conoid tubercle on under surface of clavicle.

INTERARTICULAR FIBRO-CARTILAGE — Wedge-shaped with base turned upwards and attached to superior acromio-clavicular ligament. Is frequently absent, and rarely divides the articulation into two cavities, so that there is generally but one synovial membrane.

PROPER LIGAMENTS of the SCAPULA

Are two in number.

Anterior, or Coraco-Acromial – Broad, thick, triangular; from
Apex of acromion to
Whole length of outer border of coracoid process. – It completes the vault formed by the coracoid & acromion processes above the head of the humerus, and prevents dislocation of the humerus upwards. – A bursa is interposed between it and the humerus.

Posterior, Transverse, or Suprascapular – Narrow band from
Base of coracoid process to
Inner margin of suprascapular notch, which it converts into a foramen for suprascapular nerve.

THE SHOULDER-JOINT

Is an enarthrodial articulation, though not a typical one; for the glenoid cavity of the scapula is, in comparison with the head of the humerus, remarkably small & shallow, and there is little more than a mere apposition between the two bones. Considerable mobility is thus provided for. Displacement is, on the other hand, prevented to a great extent by the presence of the acromion & coracoid processes & coraco-acromial ligament. – The articular cartilage is thickest in the centre, on the head of the humerus, thickest at the periphery, on the glenoid cavity

LIGAMENTS:

Capsular – From

Neck of scapula round margin of glenoid cavity to
Anatomical neck of humerus, extending farthest down humerus along its inner aspect.

This capsule is thicker above than below. It is strengthened by the corac humeral ligament externally, by the tendons of the supra- & infraspinatus & ter minor behind, and by that of the subscapularis in fron

It has two, sometimes three openings, through which the synovial men brane is prolonged upon the tendons of the subscapularis & biceps, and sometim upon that of the infraspinatus. The tendon of the long head of the biceps pe forates the lower part of the capsule, and becomes surrounded, within the join by a complete sheath of synovial membran

It is remarkably loose, and, when the muscles are cut, it admits of the bon being separated more than an inch. The bones are therefore kept in appositi less by the ligaments themselves than by muscular action & atmospheric pressu

Coraco-humeral, or Accessory – Strong flat band intimately blended with the capsu and extending obliquely fr

Root & outer border of coracoid process to
Front of great tuberosity of humerus.

Glenoid – Would be better described as an extension of the glenoid cavity than as a lig ment, for, unlike the cotyloid ligament of the hip-joint, it does not assist keeping the bones together. It is a fibro-cartilaginous ring triangular on sectic its thickest portion is attached to the circumference of the glenoid cavity, and sharp edge is free. It is continuous above with the tendon of the long head of t biceps, by the bifurcation of which it is partly form

SYNOVIAL MEMBRANE

— Is prolonged through the above mentioned openings in t caps

Upon the tendon of the biceps, in the shape of a complete sheath, which allows the tend to traverse the articular cavity without being contained there

Upon the tendon of the subscapularis in the shape of a pouch of variable size compris between the tendon & the subscapular fossa ; and sometin

Upon the tendon of the infra-spinatus in a similar manner; an independent bursa exi ing at other times between the muscle & the infraspinous fossa. – independent bursa exists between the upper part of the capsule the coraco-acromial ligament & delto

VASCULAR & NERVE SUPPLY

— From the circumflex & supra-scapular vessels & nerv

MOVEMENTS

— The shoulder joint is the freest of all the joints of the body, and admits movement in every direction. The acromion & coracoid processes & the cora acromial ligament prevent displacement upwards of the head of the humer and limit, unless the scapula be displaced, the elevation of the arm to about t horizontal positi

THE ELBOW-JOINT

Is a ginglymoid articulation between the trochlea & the radial tuberosity or capitellum of the humerus, on the one hand, and, on the other, the greater sigmoid cavity of the ulna & the cup-shaped depression on the head of the radius. – The articular surfaces of the radius & ulna are continuous with those of the superior radio-ulnar articulation.

LIGAMENTS — Are:

Anterior – Broad & pretty thick layer of superficial oblique & deeper vertical fibres extending from
Inner condyle & front of humerus just above coronoid fossa to
Orbicular ligament of radius & under surface of coronoid process of ulna, – to which vertical & oblique fibres a few transverse ones are added.

Posterior – Thin & membranous; consists of a few irregular fibres mainly transverse, which connect
Apex & sides of olecranon process to
Margin of olecranon fossa.

External Lateral – Thick, strong, triangular, shorter & narrower than the internal; from
External condyle to
Orbicular ligament of radius & outer border of ulna.

Internal Lateral – Thick, strong, triangular; longer & broader than foregoing, and divided into anterior & posterior portions extending respectively from
Front, and from *lower & back part of inner condyle*, respectively to
Inner border of coronoid process, and *inner border of olecranon.*

SYNOVIAL MEMBRANE — Lines the coronoid & olecranon fossæ, and dips down between the articular surfaces of the superior radio-ulnar articulation.

VASCULAR & NERVE SUPPLY – From the superior & inferior profunda, & the radial, ulnar & interosseous recurrent arteries, and from the ulnar & musculo-cutaneous nerves.

MOVEMENTS — Flexion & extension only, which are limited by the locking of the coronoid & olecranon processes in their respective fossæ. – The inner border of the trochlea descending lower than the outer one, the axis of rotation is oblique downwards & inwards; the path of motion lies, therefore, in a plane, oblique downwards & outwards, which circumstance, as is remarked by Cruveilhier, brings the hand during flexion naturally and without effort towards the mouth.

RADIO-ULNAR ARTICULATIONS.

Three in number, superior, middle, & inferior, the middle one consisting merely of two ligaments, the interosseous & the oblique or round.

SUPERIOR RADIO-ULNAR ARTICULATION — Lateral ginglymus or diarthrosis rotatorius between circumference of head of radius, on the one hand, and lesser sigmoid cavity & inner surface of orbicular ligament of radius, on the other, the lesser sigmoid cavity corresponding to the broad inner part, and the orbicular ligament to the narrow outer part of the radial articular surface. – The only ligament is the

Orbicular Ligament – Strong flat band, the four-fifths of a ring, which extends, round head & upper part of neck of radius, from
Anterior extremity to *Posterior extremity of lesser sigmoid cavity of ulna.*

The circumference of its lower border is narrower than that of its upper border, so that the head of the radius is maintained by it both against the ulna & against the capitellum of the humerus. Its inner surface is lined by the synovial membrane, and forms part of the articular surfaces of the joint. Its outer surface gives attachment to external lateral ligament of elbow-joint and to supinator brevis muscle.

MIDDLE RADIO-ULNAR ARTICULATION.

Interosseous Ligament – Strong aponeurotic plane of fibres which pass obliquely downwards & inwards between
Contiguous borders of radius & ulna.– It is broadest towards middle, perforated inferiorly for anterior interosseous vessels, and deficient above from about an inch below tubercle of radius, thus leaving for posterior interosseous vessels an opening bounded superiorly by the

Oblique or Round Ligament – Narrow fasciculus oblique downwards & outwards from
Coronoid process to
Radius half an inch below bicipital tuberosity.

INFERIOR RADIO-ULNAR ARTICULATON — Lateral ginglymus or diarthrosis rotatorius between head of ulna & sigmoid cavity of radius, to which is added an arthrodia between under surface of head of ulna & the triangular fibro-cartilage of the articulation. – The ligaments are:

Ant. Radio-Ulnar – Narrow band from
Anterior extremity of sigmoid cavity to
Front of head of ulna.

Post. Radio-Ulnar – Narrow band from
Posterior extremity of sigmoid cavity to
Back of head of ulna.

Triangular Fibro-Cartilage – The principal band of union, triangular, from
Lower margin of sigmoid cavity of radius to
Depression at root of styloid process of ulna.

Its upper & under surfaces are lined respectively with the synovial membranes of the inferior radio-ulnar & radio-carpal articulations, and they come in contact, the one with the head of the ulna, the other with the cuneiform bone. Its margins are blended with the surrounding ligaments. It is thinnest in the centre, and sometimes perforated; the two synovial membranes above mentioned are then continuous with each other.

Synovial Membrane – Is very loose, and is termed the *membrana sacciformis.* It extends between the triangular fibro-cartilage & the head of the ulna, and becomes continuous, when the former is perforated, with the synovial membrane of the wrist-joint.

THE WRIST-JOINT

Is a condyloid articulation.

ARTICULAR SURFACES:

The Condyle – Is formed by three bones, the scaphoid, semilunar, & cuneiform.

The Receiving Cavity – Is formed by the under surface of the radius & by the triangular fibro-cartilage of the inferior radio-ulnar articulation. – The under surface of the radius is divided by a linear elevation into two portions, the outer triangular, the inner quadrilateral, which portions correspond respectively to the scaphoid and the semilunar; the cuneiform articulates with the under surface of the triangular fibro-cartilage.

LIGAMENTS:

External Lateral – Short strong band, from

Apex of styloid process of radius to

Outer side of scaphoid & trapezium, & anterior annular ligament of carpus.

Internal Lateral – Round cord, from

Apex of styloid process of ulna to

Cuneiform & pisiform bones, & anterior annular ligament.

Anterior –Strong & broad membrane, from

Front of head of ulna, anterior margin of radius & its styloid process to

Scaphoid, semilunar, cuneiform, & slightly to os magnum.

Posterior – Thinner, from

Posterior margin of radius to

Scaphoid, semilunar & cuneiform.

VASCULAR & NERVE SUPPLY — Anterior & posterior carpal branches of radial & ulnar, anterior & posterior interosseous arteries, ascending branches of deep palmar arch. – Ulnar nerve.

MOVEMENTS — All but rotation.

THE ARTICULATIONS of the HAND

Are *Carpal, Carpo-metacarpal, Metacarpo-metacarpal, Metacarpo-phalangeal, & Phalangeal.*

CARPAL ARTICULATIONS — Are:-

Articulations of Bones of First Row.

Scaphoid, Semilunar & Cuneiform – Are joined together by two arthrodial articulations, of which the ligaments are:

Dorsal, Palmar, Interosseous. } Two of each, of which the interosseous are the strongest & most important, and the palmar the least important; they join dorsal, palmar & upper part of contiguous surfaces of the three bones.

Pisiform – Is joined to cuneiform by a separate arthrodial articulation having a special synovial membrane, and two strong ligaments, which latter connect the pisiform bone to the unciform & to the base of the 5th metacarpal.

Articulations of Bones of Second Row.

Trapezium, Trapezoid, Os Magnum & Unciform – Are joined together by three arthrodial articulations, of which the ligaments are:

Dorsal, Palmar. } Three of each, of which the dorsal are the thickest & strongest.

Interosseous – Three, strong. Sometimes only two, the one between trapezium & trapezoid being occasionally wanting

Articulation of the First Row of Bones with the Second Row of Bones.

Consists *laterally* of two arthrodial articulations between the cuneiform & unciform and between the scaphoid and the trapezium & trapezoid, and *in the centre,* of a kind of enarthodial articulation formed by the reception of the head of the os magnum & of the upper part of the unciform into concavity of scaphoid, semilunar & cuneiform.–The ligaments are:

Dorsal – Short, irregular.

Palmar – Converge towards os magnum.

Lateral – Continuous with lateral ligaments of wrist-joint; connect scaphoid to trapezium, and cuneiform to unciform

CARPO-METACARPAL ARTICULATIONS.

Articulation of Trapezium with Metacarpal Bone of Thumb – Is an articulation by reciprocal reception; the articular surfaces are saddle-shaped that of the trapezium being convex from side to side & concave from before backwards, and that of the first metacarpal bone being concave from side to side & convex from before backwards. The bones are joined together by a

Capsular Ligament – Thick, but loose, strongest externally & behind, and lined by a separate synovial membrane

Articulations of Carpus with Four Inner Metacarpal Bones–Are four arthrodial between:-

Second Metacarpal Bone and Trapezium, Trapezoides & Os Magnum;
Third Metacarpal Bone „ Os Magnum;
Fourth Metacarpal Bone „ Os Magnum & Unciform;
Fifth Metacarpal Bone „ Unciform. – The ligaments are:

Dorsal – The strongest; two to each metacarpal bone except the 5th which has but one

Palmar – Thinner; three to 3rd metacarpal bone.

Interosseous – Connect adjacent surfaces of 3rd & 4th metacarpal bones to contiguou inferior angles of os magnum & unciform

METACARPO-METACARPAL ARTICULATIONS — The metacarpal bone of th thumb is not connected to the other bones of the metacarpus. The four inner meta carpal bones are connected to each other both at their carpal & at their digital extremities

Carpal Extremities – Are connected by three arthrodial articulations, of whicl the ligaments are:

Dorsal, Palmar. } Irregular, mainly transverse.

Interosseous – Pass between the bones just below their articular facets.

Digital Extremities – Are all joined together by the

Transverse Ligament of the Metacarpus – Single transverse band which crosses the whol width of the metacarpus, and blends inferiorly with the glenoid ligaments c the metacarpo-phalangeal articulations

METACARPO-PHALANGEAL ARTICULATIONS — Are condyloid articulation between rounded heads of the metacarpal bones & oval concave articular surfaces of th corresponding phalanges. – The ligaments are

Anterior or Glenoid (Cruveilhier) – Thick fibro-cartilaginous structures continuous later ally with the lateral ligaments, and above with the transverse ligament c the metacarpus; their posterior aspect is lined with synovial membrane and forms part of cavity for head of metacarpal bone; their anterior aspec is grooved for passage of flexor tendons, with steath of which tendon it blends on either side

Lateral – Strong rounded cords from posterior tubercle on sides of heads of metacarpa bones to glenoid ligament & sides of first phalanges

PHALANGEAL ARTICULATIONS — Are ginglymoid articulations; the distal extremitie of the two first phalanges are trochlear in shape; the corresponding extremities of th second & third phalanges present two lateral articular concavities separated by a me dian ridge. The ligaments are the same as the in foregoing articulations

For Synovial Membranes of Carpus, Vide next Tablet.

FASCIÆ & SYNOVIAL MEMBRANES of the HAND & WRIST.

FASCIÆ — Are rather ligaments than fasciæ proper, and are therefore described here.

Anterior Annular Ligament of the Wrist – Continuous above with deep fascia of forearm, and below with palmar fascia; extends from

Pisiform bone & unciform process of unciform to
Tubercle of scaphoid, & ridge on anterior surface of trapezium.

It is pierced by tendon of flexor carpi radialis.

Beneath it pass the flexores sublimis & profundus digitorum enclosed in one synovial sheath, the flexor longus pollicis enclosed in another sheath, and the median n.

Into its anterior surface & upper border are inserted a few fibres of the palmaris longus & flexor carpi ulnaris.

From its lower border arise in part the abductor, opponens & outer head of flexor brevis pollicis, and the flexor brevis & opponens minimi digiti.

Posterior Annular Ligament of the Wrist – Thinner than foregoing, from

Cuneiform & pisiform bones, and lower part of ulna to
Styloid process & ridges on posterior aspect of radius.

Presents six divisions or compartments lined each of them with a separate synovial membrane, and which, from without inwards, correspond to the following osseous grooves, and transmit the following muscles:–

1. – Corresponds to shallow groove on outer side of styloid process of radius. – Transmits extensores ossis metacarpi & primi internodii pollicis.
2. – Corresponds to broad & shallow groove on posterior aspect of styloid process. – Transmits extensores carpi radiales longior & brevior.
3. – Corresponds to narrow & deep groove on back of lower extremity of radius. – Transmits extensor secundi internodii pollicis.
4. – Corresponds to broad & shallow groove on back of lower extremity of radius. – Transmits extensores indicis & communis digitorum.
5. – Corresponds to groove at point of articulation of radius & ulna. – Transmits extensor minimi digiti.
6. – Corresponds to groove on back of head of ulna. – Transmits extensor carpi ulnaris.

Palmar Fascia — Consists of

TWO LATERAL PORTIONS – Thin. Cover muscles of thumb & little finger, and send processes between them.

CENTRAL PORTION – Thick, strong, triangular; firmly adherent to integument; covers superficial palmar arch, flexor tendons, & median & ulnar nerves, and gives origin internally to palmaris brevis. It is narrow above, where it receives expanded tendon of palmaris longus, and is attached to anterior annular ligament; and broad below, where it divides into four slips bound together by transverse fibres. Each slip subdivides into two processes, which processes embrace the flexor tendons, and become attached to bases of first phalanges & glenoid ligaments. Between the slips are seen the palmar interosseous & digital arteries, the terminal branches of the median & ulnar nerves, & the tendons of the lumbricales.

SYNOVIAL MEMBRANES — Are articular & tendinous.

Articular – Five:–

1. – *Membrana Sacciformis* of the inferior radio-ulnar articulation.
2. – *Synovial membrane of the radio-carpal articulation,* comprised between the first row of carpal bones & the under surface of the radius & triangular fibro-cartilage.
3. – *General synovial membrane of the carpus,* comprised between bones of first row, between bones of second row, between the two rows of bones, between the second row of carpal bones & the four inner metacarpal bones, and finally between the four inner metacarpal bones.
4. – *Synovial membrane of the carpo-metacarpal articulation of the thumb.*
5. – *Synovial membrane of the articulation between the cuneiform & pisiform.*

Tendinous – Vide Anterior & Posterior Annular Ligaments.

THE HIP-JOINT

Is *the* typical enarthrodial articulation.

ARTICULAR SURFACES:

Acetabulum – Deep, hemispherical, further deepened in the fresh condition by the cotyloi & transverse ligaments. Looks downwards, outwards & forwards. Is divided into

Incomplete Articular Ring – Broadest above & behind, and deficient below & in front.

Central Non-Articular Depression – Continuous with cotyloid notch; lodges a mass c fat, which forms a bed for the round ligamen

Head of Femur – Forms nearly two-thirds of a sphere, and, in the normal position of th limb, looks upwards, inwards & forwards. It presents a little below & behind it centre a small circular depression for attachment of ligamentum teres; near thi depression the cartilage is thicker than elsewher

LIGAMENTS — Are: –

Capsular – Short & thick, especially above & in front; thinner & looser below & behind; some times perforated beneath psoas. – It extends fron

Outer lip of margin of acetabulum within two or three lines of the cotyloid ligament, and, opposi the cotyloid notch, from transverse ligament & edge of obturator foramen t

Anterior intertrochanteric line in front; base of neck of femur, above; and, behind, to back of ne of femur, within about half an inch from lesser trochanter & posterior intertrochanteric lin

Ilio-Femoral or Accessory – A thickened band closely connected with front of capsul which extends obliquely fro

Anterior inferior spine of ilium to

Lower part of anterior intertrochanteric line.

There are also several other accessory bands, viz., one on the outer side of t ilio-femoral termed the *Ilio-trochanteric*, one on the inner side of the ilio-femor termed the *Pubo-femoral;* also a transverse band at the back of the join

Round Ligament or Ligamentum Teres – Interarticular band about an inch long an of very variable strength & thickness, attached, on the one hand,

Depression a little below & behind centre of head of femur, and on the other hand, dividing in two fasciculi,

Margins of cotyloid notch; the two fasciculi blending with the transverse ligament. conveys a few vessels to head of femu

Cotyloid – Incomplete fibro-cartilaginous ring triangular on section, presenting a base attach to margin of acetabulum, and a sharp free edge which closely embraces head of femu It is thickest above & behind, and deficient opposite the cotyloid notch, where it is co tinued into the transverse ligament. It consists of closely interlaced oblique fibr arising from the different points of the rim of the bo

Transverse – Strong flattened band, a continuation of the foregoing, which extends from o side of the cotyloid notch to the other, transforming it into a complete forame

SYNOVIAL MEMBRANE — Invests whole of anterior surface & greater part of posterior su face of neck of femur, cotyloid ligament, mass of fat at bottom of acetabulum, & ligamentu teres. – It communicates sometimes through a small opening in the capsule with the bur beneath psoas & iliac

VASCULAR & NERVE SUPPLY — From obturator, sciatic & internal circumflex arteries, a from great sciatic, obturator & accessory obturator nerv

MOVEMENTS — Are flexion, extension, adduction, abduction, rotation & circumduction. –

Flexion is freer then extension: the thigh can be brought forwards till it touches the a domen, but it cannot be carried backwards to anything like the same extent. Flexion, in fa is scarcely interfered with by the posterior part of the capsule, which is thin & loose; exte sion, on the contary, is soon arrested by the ilio-femoral ligament and by the anterior p of the capsule, which is short & thick

Of the two lateral movements abduction is the freest; it is checked by the action of t pubo-femoral band. Adduction is checked mainly by the two limbs coming in contact, b also partly by the action of the ilio-trochanteric band. When however flexion & adducti are combined, so that one limb passes in front of the other, the double movement may carried very far; it is at last arrested, by the action of the round ligament. The round lig ment is also tensed when flexion & abduction are combined and carried to a consideral extent, and when the limb is rotated outwar

Rotation inwards is freer than rotation outwards (rotation being measured from the int mediate position which the foot normally occupies in standing); this is partly due to t greater laxity of the capsule behind than in front, and partly also to the direction forwa both of the head of the femur & of the acetabulum. Rotation takes place round an imagina line extending from the head of the femur to the centre of the knee-joint. – Circumduction, all other movements generally, is much less free in the hip than in the sholder-joi

The weight of the limb at the hip-joint is normally supported by atmospheric pressure In consequence of the complete exclusion of air from the joint through the accurate adap tion of the cotyloid & transverse ligaments to the head of the femur, the latter is firmly tained in the acetabulum even after all the soft parts around the joint have been divided; air be allowed to penetrate into the joint through a perforation of the acetabulum fr within, tle limb will immediately dr

KNEE-JOINT — 1st Tablet.

May be described as a double condyloid articulation with a superadded arthrodia. This view is supported by comparative anatomy, for in many mammalia the knee-joint consists of three distinct articulations having separate articular surfaces, separate synovial membranes, & separate ligaments. In man the articular surface of the femur presents three distinct portions, the synovial cavity is partly divided into two by the ligamentum mucosum, and the arrangement of the crucial ligaments clearly suggests that they are to be considered as the adjacent lateral ligaments, internal & external, of the external & internal femoro-tibial joints.

ARTICULAR SURFACES:

Articular Surfaces of the Femur – Three in number, separated by two slightly depressed posteriorly converging lines, of which lines the one that bounds the patellar surface internally is continued backwards along the outer & front part of the inner condyle so as to cut off an additional narrow tract from the inner side of the intercondyloid notch.

Patellar Surface – Occupies front part of condyles, is trochlear in shape, broadest, highest & most prominent externally; it presents a slight prolongation backwards along inner side of intercondyloid notch, which prolongation it is that articulates during flexion of the knee-joint with the small facet on posterior aspect or inner border of patella (Lenoir, Goodsir).

Tibial Surfaces – Cover the slightly flattened under surfaces & the posterior rounded surfaces of the condyles. – The tibial surface of the inner condyle is more elongated than that of the outer, and it describes anteriorly a curve of a semi-horse-shoe shape, the convexity of which curve is turned forwards & inwards.

Articular Surfaces of the Tibia – Two, the two condyloid surfaces, slightly concave, separated by the spine & the rough depressions in front of & behind it.

Int. Condyloid Surface – The longest, narrowest & deepest.

Ext. Condyloid Surface – The shortest, broadest & shallowest.

Articular Surface of the Patella – Divided by a vertical ridge into two lateral & slightly concave portions, of which the

Outer Portion – Is the largest & deepest, while the

Inner Portion – Is the smallest & shallowest, and is further diminished internally by a slightly marked ridge, which ridge cuts off a narrow marginal facet coming in contact, during flexion of the knee-joint, with the inner border of the intercondyloid notch (Lenoir, Goodsir). – In well marked bones the two principal portions of the articular surface are divided by two transverse ridges into three horizontal bands, which bands rest in succession upon the femoral trochlea during the movements of flexion & extension of the joint (Goodsir).

N. — THE INTERARTICULAR FIBRO-CARTILAGES – (Vide Next Tablet) – May also be considered as forming part of the articular surfaces: – They increase the extent & depth of tibial sockets, whose form they also modify in adaptation to the different curves of the several parts of the femoral condyles.

KNEE-JOINT — 2nd Tablet.

INTERARTICULAR SEMILUNAR FIBRO-CARTILAGES

May be considered as forming part of the articular surfaces: – They increase the ext & depth of the tibial sockets, whose form they also modify in adaptation to the dif ent curves of the several parts of the femoral condyles; they are everywhere inves by the synovial membrane, except along their convex border. – Each one preser

Under Surface – Flat; rests upon head of tibia.

Upper Surface – Concave; supports condyle of femur.

Concave Border – Thin, free.

Convex Border – Thick, blended with capsule (especially in the case of the internal o), attached to head of tibia by numerous short vertical bands forming the *coro* *ligaments*, and connected anteriorly to convex border of its fellow by a thi variable transverse band, the *transverse ligan*

Anterior Extremity – Thin & pointed in the case of the internal one, coarsel brous, attached to small pits on rough triangular depression in front of spin tibia, *the anterior extremity of the internal* semilunar fibro-cartilage lying *in* *& to the inner side of*, and *the anterior extremity of the external* semilunar fi cartilage lying *behind & to the outer side of*, the tibial attachment of the *ant* *crucial* ligam

Posterior Extremity – Thickest & broadest in the case of the internal one, also coar fibrous, attached to small pits on rough triangular depression behind the s *the posterior extremity of the internal* semilunar fibro-cartilage lying *behind & i* *nally to the posterior extremity of the external* semilunar fibro-cartilage, and *bot* them lying *in front of* the tibial attachment of the *posterior crucial* ligan

INTERNAL SEMILUNAR FIBRO-CARTILAGE — Is narrower & elongated than the external one, and covers a smaller portion of the co ponding articular surface of the tibia. It embraces by its anterior & poste extremities, the anterior & posterior extremities of the external semilunar f cartilage. Its convex border is blended with the capsule along nearly whole of its ex

EXTERNAL SEMILUNAR FIBRO-CARTILAGE — Is broader & more cular than the internal one, and covers a larger portion of the correspon articular surface of the tibia. Its anterior & posterior extremities are embr by the anterior & posterior extremities of the internal semilunar fibro-carti Its anterior extremity is blended with the anterior crucial ligament. Its terior extremity gives off three processes, of which two are attached to inner tuberosity of the tibia in front of & behind the posterior crucial ligan while the third one passes up with this ligament to be attached with it to inner condyle of the femur. Its convex border is less extensively conne with the capsule than that of the internal one, for, on the one hand, its extr ties lie in the centre of the joint, and, on the other hand, the tendon of the p teus intervenes between it & the capsule at its outer & back

KNEE-JOINT —3rd Tablet.

LIGAMENTS — Are the: -

Anterior Ligament or Ligamentum Patellæ - Strong flat band about three inches long, a continuation of tendon of rectus femoris, which extends from
Apex of patella & rough depression below its articular surface to
Lower part of tubercle of tibia, being separated from upper part of the tubercle by a small bursa. - It is separated from the synovial membrane of the knee-joint by a considerable mass of adipose tissue.

Posterior Ligament - Consists of three portions (Cruveilhier, Gray): -

Central Portion or Ligamentum Posticum Winslowii (The only portion described either by Winslow, or by Heath, Quain, & many modern Authors) - Broad flat band partly derived from tendon of semimembranosus, and which extends obliquely from
Back part of inner tuberosity of tibia to
Upper & back part of outer condyle of femur.

Two Lateral Portions (Capsule Fibreuse des Condyles, Cruveilhier) - Closely connected with tendons of gastrocnemius, popliteus, plantaris, and formed chiefly of vertical fibres extending from
Condyles just above their articular surfaces to
Back of head of tibia. - These lateral portions are looked upon by many anatomists as a part of the capsular ligament.

Internal Lateral Ligament - Broad flat band from
Back part of inner tuberosity of femur to
Inner tuberosity & upper part of inner surface of shaft of tibia. - Covers anterior portion of tendon of semimembranosus & inferior internal articular vessels, and is covered by tendons of sartorius, gracilis & semitendinosus, a bursa being interposed.

External Lateral Ligament - Consists of two portions: -

Long External Lateral Ligament - Strong rounded cord from
Back part of outer tuberosity of femur to
Outer part of head of fibula. - It is embraced by the two fasciculi into which the tendon of the biceps divides, and beneath it pass tendon of popliteus & inferior external articular vessels.

Short External Lateral Ligament - Accessory & somewhat variable bundle of fibres intimately blended with capsule, lying behind foregoing & on outer side of tendon of popliteus, and extending from
Lower & back part of outer tuberosity of femur to
Apex of styloid process of fibula.

Capsular Ligament - Lies in contact with the synovial membrane, and beneath the other ligaments, which it binds together. It is strengthened by expansions from the fascia lata and from the vasti, biceps, sartorius & semimembranosus; the expansions from the fascia lata & the vasti forming, on either side of the patella, the so-called *lateral patellar ligaments.* It is attached to
Femur just above the articular surfaces,
Upper border & sides of patella,
Margins of head of tibia & semilunar fibro-cartilages.

Crucial Ligaments - Two, project into the interior of the joint from behind, and cross each other obliquely like the bars of an X.

Anterior Crucial Ligament - The most oblique & somewhat the smaller, from
Inner part of rough triangular depression in front of spine of tibia between points of attachment of anterior extremities of both semilunar fibro-cartilages, and partly also from anterior extremity of the external semilunar fibro-cartilage itself to
Inner & back part of outer condyle of femur.

Posterior Crucial Ligament - The thickest & strongest. Nearly vertically from
Back part of rough depression behind spine of tibia, behind points of attachment of posterior extremities of both semilunar fibro-cartilages, and partly from posterior extremity of external semilunar fibro-cartilage itself to
Anterior & outer part of inner condyle of femur & front of intercondyloid notch.

Transverse & Coronary Ligaments - Vide preceding Tablet.

Ligamentum Mucosum & Ligamenta Alaria - Vide next Tablet.

KNEE-JOINT — 4th Tablet.

SYNOVIAL MEMBRANE.

Is the largest synovial membrane in the body.
Its particularities are as follows: –

1. That it forms a large cul-de-sac beneath the extensor muscles of the gh which cul-de-sac extends upwards for an inch or two above the articular surface an is supported during the movements of the joint by the subcruræus muscle, wh i inserted into it. – This cul-de-sac is sometimes replaced by a bursa, which may om municate with the synovial membrane of the knee-joint by an opening of variabl ize

2. That on each side of the patella it extends a considerable distance be ath the aponeuroses of the vasti, covering the tuberosities of the femur, especial th inner one.

3. That below the patella it rests upon a large quantity of adipose tissue, ich adipose tissue, projecting into the joint in the shape of three processes sheathe ith synovial membrane, forms the *ligamentum mucosum* and the *ligamenta alaria.* Th former is attached to the front of the intercondyloid notch; the two latter pas bli quely from the ligamentum mucosum, and fit into the space between the tibia, p lla and femur. – The ligamentum mucosum supports the synovial membrane & t fa below the patella when the patella tends to descend in front of the knee-joint. hi happens when, in the standing position, the body rests against some external ect for both flexor & extensor muscles then relax, their action being unnecessary to ain tain the equilibrium.

4. That it invests the semilunar fibro-cartilages except at their convex at tached margin, and surrounds the crucial ligaments laterally & in front.

5. That it extends, under cover of the capsule, beneath the heads of the ga oc nemius, and is prolonged through an opening in the capsule, beneath the ten o the popliteus.

6. That it is sometimes continued into the superior tibio-fibular articulatio

VASCULAR & NERVE SUPPLY — From the five articular branches of th op liteal artery, the anastomotica magna, & the recurrent branch of the tibial, and om the anterior crural, obturator, & internal & external popliteal nerves.

KNEE-JOINT — 5th Tablet.

MOVEMENTS — Are

1. – *Antero-posterior* combined with a slight amount of rotation of the tibia, inwards in flexion, outwards in extension.

2. – *Independent rotatory movements.*

ANTERO-POSTERIOR MOVEMENTS:

1. The tibia glides backwards & forwards upon the femoral condyles, rotating slightly inwards in flexion, outwards in extension, the semilunar fibro-cartilages at the same time receding towards the centre, or spreading out towards the periphery of the tibial sockets, in adaptation of the size & curve of these sockets to the greater or less convexity of the several portions of the femoral condyles. – It is towards the anterior & posterior extremities of the tibial sockets that the semilunar fibro-cartilages are most movable, and the external fibro-cartilage is the most movable of the two.
2. The patella moves in a plane oblique downwards & outwards.

In Extreme Flexion

1. The tibial sockets lie in contact with the posterior rounded portion of the femoral condyles, and their concavity is increased & their area diminished by the recession of the semilunar fibro-cartilages towards the centre of the joint.
2. The patella lies on the outer side of the joint. The upper part of its articular surface (or the upper of the three horizontal bands into which, in well marked bones, this articular surface is divided) rests upon the lower part of the patellar surface of the femur; its narrow marginal facet rests upon the inner border of the intercondyloid notch.

As the Leg is Brought Forwards

1. The tibial sockets glide forwards, *first slowly & both at the same rate*, over the posterior rounded portion of the condyles (over which posterior rounded portion a very slight displacement of the tibial sockets corresponds to a considerable angular movement of the leg), *then more rapidly*, *and the internal tibial socket more rapidly than the outer one*, over the inferior flattened portion of the condyles, the tibia rotating slightly outwards. – The semilunar fibro-cartilages spread out at the same time towards the periphery of the tibial sockets, both diminishing their concavity and increasing their area.
2. The patella passes upwards & inwards in front of the joint, and the middle part of its articular surface (or the second of the three bands into which, in well marked bones, this articular surface is divided) comes in contact with, and ascends upon, the femoral trochlea.

In Complete Extension.

1. The tibial sockets reach the anterior limits of the tibial portion of the femoral condyles; the semilunar fibro-cartilages still further spread out towards the periphery of the joint.
2. The patella ascends almost entirely above the femoral trochlea, the lower part only of its posterior surface (or the lower only of the three bands into which, in well marked bones, that surface is divided) still resting upon the femoral articular surface. The bone lies prominently therefore at the upper & inner part of the joint; it is freely movable from side to side when the extensor muscles are relaxed; its apex is directed downwards & outwards.

The *ligamentum patellæ* is stretched in the flexed, and relaxed in the extended position of the joint (if the extensor muscles are not in a state of contraction). The *lateral* & the *posterior ligaments* are stretched in the extended, and relaxed in the flexed position. The *crucial ligaments* are relaxed in all the intermediate positions; they only come into play, the anterior one in nearly complete extension, the posterior one in nearly complete flexion.

INDEPENDENT ROTATORY MOVEMENTS — Take place only in the semi-flexed position of the limb, when (Vide above) all the ligaments are relaxed. Rotation inwards is produced by the popliteus, and is bounded by the interlocking of the crucial ligaments & by the separate action of the anterior one. Rotation outwards is produced by the biceps, and is bounded by the action of the lateral ligaments, of which the inner one is first put on the stretch.

TIBIO-FIBULAR ARTICULATIONS

Are three in number, the superior, middle, & inferior, the middle one consisting merely of t interosseous membra

SUPERIOR TIBIO-FIBULAR ARTICULATION — Is an arthrodia. The articu surfaces are small, oval, flat, oblique downwards & inwards. The synovial me brane is sometimes continuous with that of the knee-joint. The ligaments a

Anterior Superior Tibio-Fibular – Two or three strong flat bands extend obliquely fr

Front of head of fibula to
Front of outer tuberosity of tibia.

Posterior Superior Tibio-Fibular – Single thick band extending obliquely fi
Back of head of fibula to
Back of outer tuberosity of tibia.

MIDDLE TIBIO-FIBULAR ARTICULATION.

Interosseous Membrane – Strong aponeurotic plane of fibres which pass obliq y downwards & outwards betw n
Contiguous borders of tibia & fibula – It is broader above than below, d presents superiorly a large aperture for the anterior tibial vessels, d inferiorly, a smaller one for the anterior peroneal. It is continuous be v with the interosseous tibio-fibular ligam .

INFERIOR TIBIO-FIBULAR ARTICULATION — Is an amphiarthrosis (Cru - hier). Inferiorly, over an extent of about two lines, the two bones are flat, smoot & covered with a layer of cartilage continuous with that of the ankle-joint; above s they are rough, and the tibial surface is concave and the fibular surface conve - The ligaments :

Anterior Inferior Tibio-Fibular – Triangular flat band extending obliquely f n
Front of external malleolus to
Front of lower part of tibia.

Posterior Inferior Tibio-Fibular – Narrow & thinner band from
Back of external malleolus to
Back of lower part of tibia – It is continuous inferiorly with the transverse l - n t.

Interosseous – The chief bond of union. Formed of short strong fibres exten g betv n
Contiguous rough surfaces of tibia & fibula.

Transverse – Long narrow band which projects posteriorly below the margins & e bones, and forms part of the articular surface for the astragalus; it x- tends m
Back of external malleolus to
Back of lower part of tibia a short distance from the internal malleolus.

HE ANKLE-JOINT

Is a ginglymoid articulation.

ARTICULAR SURFACES: -

The Trochlea - Is formed by the upper articular surface & the two lateral facets of the astragalus. The upper articular surface is broadest in front, convex from before backwards, & slightly concave from side to side; its outer border is a little longer than the inner one, and is slightly curved inwards posteriorly. Of the two lateral facets, the external one is the largest.

The Receiving Cavity - Is formed by the under surface of the lower extremity of the tibia, and by the outer & inner surfaces respectively of the internal & external malleoli. The under surface of the lower extremity of the tibia is quadrilateral, broadest in front, concave from before backwards, and marked by a slight antero-posterior elevation separating two shallow lateral depressions. Of the articular facets of the two malleoli, that of the outer one is the largest.

LIGAMENTS — Are: -

Anterior & Posterior - Very thin, especially the posterior one, and consisting merely of a few scattered fibres extending between the tibia & the astragalus at the margin of their articular surfaces. - The fibres of the posterior ligament are mainly transverse.

Internal Lateral - Consists of two layers: -

Superficial Layer, or Deltoid Ligament - Strong triangular band, which radiates from

Apex and anterior & posterior borders of internal malleolus to

Inner part of scaphoid & inferior calcaneo-scaphoid ligament; lesser process of os calcis; and back part of inner surface of astragalus.

Deep Layer (Cruveilhier, Gray) - Short thick vertical band from

Apex of internal malleolus to

Inner surface of astragalus below its articular facet.

External Lateral - Consists of three separate fasciculi: -

Anterior Fasciculus - Short, thick, nearly horizontally from

Anterior border of external malleolus to

Astragalus in front of its external articular facet.

Middle Fasciculus - Longer, rounded, from

Apex of external malleolus to

Middle of outer surface of os calcis.

Posterior Fasciculus - The strongest, deeply situated; nearly horizontally from

Depression at inner & back part of external malleolus to

Astragalus behind its external articular facet as far as groove for flexor longus pollicis.

SYNOVIAL MEMBRANE - Communicates with that of the inferior tibio-fibular articulation.

VASCULAR & NERVE SUPPLY — From the malleolar branches of the anterior tibial and the termination of the anterior peroneal, and from the anterior tibial nerve.

MOVEMENTS — Are flexion & extension with a slight amount of lateral mobility in the extended position. - In the flexed position the wide anterior part of the trochlea lies in the narrow posterior part of the receiving cavity, and the posterior fibres of the lateral ligaments are on the stretch; all lateral movement is then impossible. In the extended position the narrow posterior part of the trochlea lies in the wide anterior part of the receiving cavity, and, the lateral ligaments being relaxed (except in forced extension), a considerable amount of lateral movement is permitted: - Adduction is produced by the tibialis anticus, abduction by the peronei. In forced extension, however, the anterior fibres of the lateral ligaments become tensed, and movement from side to side is again prohibited. - Forced extension is accompanied by a slight amount of adduction in consequence of the outer border of the trochlea being a little longer than the inner one and slightly curved inwards posteriorly.

ARTICULATIONS of the FOOT

Are *tarsal, tarso-metatarsal, metatarso-metatarsal, metatarso-phalangeal & phalangeal.*

TARSAL ARTICULATIONS — Form three sets: -

Articulations of Bones of First Row.

ASTRAGALUS & OS CALCIS are joined by two arthrodial articulations, of which the ligament

Interosseous Calcaneo-Astragaloid – Broad thick band of vertical & oblique fibres passing from th groove on one bone to the deep groove on the other. It is the principal bond of

External Calcaneo-Astragaloid – Short thick band from outer surface of astragalus below its nal articular facet to outer surface of os

Posterior Calcaneo-Astragaloid – Thinner band from posterior surface of astragalus to contiguou of upper surface of os

Articulations of Bones of Second Row.

SCAPHOID, CUBOID & THE THREE CUNEIFORM BONES are joined by arthrodial articulati which the ligt

Dorsal } – Numerous, irregular; the dorsal are the thickest & strongest.
Plantar }

Interosseous – Four, strong; connect adjacent non-articular portions of the three cuneiform & the cuboid, and of the scaphoid &

Articulations of the First Row of Bones with the Second Row of Bones.

THE ASTRAGALUS & THE SCAPHOID, on the one hand, and the OS CALCIS & THE CUBOID, other, are joined by two arthrodial articulations, of which the ligamer

Sup. Astragalo-Scaphoid – Broad, thin; from upper surf. of neck of astragalus to upper surf. of sc

Sup. Calcaneo-Cuboid – Thin & narrow band joining os calcis & cuboid on their superior external

Long Calcaneo-Cuboid – Long broad & strong band from under surf. of os calcis between t & the two post. tubercles, to ridge on under surface of cuboid & to base of 2nd 3r metatarsal bones. – It transforms the groove for peroneus longus into a complete

Short Calcaneo-Cuboid – Short broad & strong band, which underlies foregoing, and which from anterior tubercle & groove on under surface of os calcis to under surface of behind peroneal

Int. or Interosseous Calcaneo-Cuboid – Short thick band from upper & inner part of greater proc calcis to inner side of cuboid. Blends posteriorly with the sup. calcaneo-scaph

To the foregoing ligaments must be added the two following, which may sidered, especially the latter one, as belonging to the astragalo-scaphoid artic

Superior Calcaneo-Scaphoid – Short thick band blended posteriorly with foregoing, and forwards anteriorly to outer side of sc

Inferior Calcaneo-Scaphoid – Very thick, strong, broad, and somewhat triangular band ex from anterior border of lesser process of os calcis to under surface of scaph supports the head of the astragalus, and forms part of the articular cavity int the latter is received; it is lined superiorly by the synovial membrane which mon to the anterior calcaneo-astragaloid & astragalo-scaphoid artic

TARSO-METATARSAL ARTICULATIONS — Are arthrodial joints between:

FIRST METATARSAL BONE and INTERNAL CUNEIFORM;
SECOND METATARSAL BONE „ ALL THREE CUNEIFORM BONES, which bones form t a deep recess into which the second metatarsal bone is re
THIRD METATARSAL BONE and EXTERNAL CUNEIFORM;
FOURTH METATARSAL BONE „ EXTERNAL CUNEIFORM (usually) & CUBOID;
FIFTH METATARSAL BONE „ CUBOID. – The ligaments are:

Dorsal – Thick; join each metatarsal bone to corresponding tarsal bone, the second me bone having three dorsal ligaments, one from each cu

Plantar – Thinner & less regular, especially those belonging to the 4th & 5th metatarsa Those belonging to the 1st & 2nd are much stronger; those belonging to the 2n are strengthened by oblique bands passing forwards from the internal cu

Interosseous – Three, strong; between internal cuneiform & 2nd metatarsal bone, and external cuneiform & 2nd & 3rd metatars

METATARSO-METATARSAL ARTICULATIONS — The metatarsal bones are conn each other, both at their tarsal & at their digital ext

TARSAL EXTREMITIES – Are connected by arthrodial articulations, except in the case of 2nd metatarsal bs., between which there is no direct contact. The lig

Dorsal }
Palmar } – Of which the interosseous are the strongest & most important, and th
Interosseous } the least in

DIGITAL EXTREMITIES – Are all joined together by the

Transverse Metatarsal Ligament – Transverse band which crosses whole width of metatar blends anteriorly with the glenoid ligaments of the metatarso-phalangeal artic

METATARSO-PHALANGEAL ARTICULATIONS — Are condyloid articulations simi metacarpo-phalangeal. The ligts. are also sir

Anterior or Glenoid (Cruveilhier) }
Lateral – Two for each. } – Vide Metacarpo-phalangeal articulations.

PHALANGEAL ARTICULATIONS — Are ginglymoid articulations similar to those of th The ligaments are the same as those of the foregoing artic

For Synovial Membranes of the Tarsus, Vide next Tablet.

ASCIÆ & SYNOVIAL MEMBRANES of the TARSUS.

FASCIÆ — Are rather ligaments than fasciæ proper, and are therefore described here.

Anterior Annular Ligament – Consists of two portions connected by a thin intervening layer of fascia.

Superior or Vertical Portion – Of considerable breadth & continuous superiorly with deep fascia of leg. It extends from lower part of anterior border of tibia to lower part of anterior border of fibula.

Inferior or Horizontal Portion. – Narrower and continuous anteriorly with deep fascia over dorsum of foot. It extends from upper surface of os calcis, in front of groove for interosseous calcaneo-astragaloid ligament, to internal malleolus & inner border of plantar fascia.

Beneath anterior annular ligament pass from within outwards: –

1. – *Tendon of tibialis anticus* contained throughout in a synovial sheath.
2. – *Tendon of extensor proprius pollicis* contained in a synovial sheath beneath the inferior or horizontal portion of the ligament only.
3. – *Anterior tibial vessels & nerve.*
4. – *Tendons of extensor longus digitorum & peroneus tertius* enclosed throughout in one synovial sheath.

Internal Annular Ligament – Strong fibrous band continuous superiorly with deep fascia of leg, and giving origin inferiorly to innermost fibres of abductor pollicis. It extends obliquely from internal malleolus to inner surface of os calcis. Beneath it pass from before backwards & outwards: –

1. – *Tendon of the tibialis posticus* contained in a synovial sheath.
2. – *Tendon of the flexor longus digitorum* contained in another synovial sheath.
3. – *Posterior tibial vessels & nerve.*
4. – *Tendon of the flexor longus pollicis* also contained in a synovial sheath, and situated at a considerable depth in a groove on posterior surface of astragalus.

External Annular Ligament – Narrower & thinner band extending from external malleolus to outer surface of os calcis, and beneath which pass *Tendons of peronei* both enclosed in one synovial sheath.

SYNOVIAL MEMBRANES — Are articular & tendinous.

Articular – Six: –

1. – *Synovial membrane of posterior calcaneo-astragaloid articulation.*
2. – *Synovial membrane common to the anterior calcaneo-astragaloid & astragalo-scaphoid articulations.*
3. – *Synovial membrane of calcaneo-cuboid articulation.*
4. – *General synovial membrane of the tarsus* comprised between the scaphoid & the three cuneiform bones, between the three cuneiform bones, between the external cuneiform bone & the cuboid, between the middle & external cuneiform bones on the one hand and the bases of the 2nd & 3rd metatarsal bones on the other, between the bases of the 2nd & 3rd metatarsal bones. – Sometimes there is a separate synovial membrane between the scaphoid & the cuboid.
5. – *Synovial membrane of the articulation between the cuboid and the 4th & 5th metatarsal bones.*
6. – *Synovial membrane of the articulation between the first cuneiform bone & the first metatarsal.*

Tendinous – Vide Annular Ligaments.

THE MUSCLES.

HE MUSCLES of the FACE

Are the:

OCCIPITO-FRONTALIS.

Frontal Portion – Innermost fibres are continuous with pyramidalis nasi, the others blend with orbicularis palpebrarum & corrugator supercilii.

Occipital Portion – Outer two-thirds of superior curved line of occipital bone, and mastoid portion of temporal.

The intervening epicranial aponeurosis is attached behind, between the two occipital portions, to the external occipital protuberance & to the superior curved lines; laterally it gives attachment to the attrahens & attollens aurem, and, becoming considerably thinned, passes over the temporal fascia to the zygoma. – It is intimately connected to the integument, loosely to the pericranium.

S., frontal portion by facial nerve, occipital portion by small occipital branch of cervical plexus & by auricular branch of facial.

MUSCLES of the EAR.

Attollens Aurem, or Auricularis Superior – Temporal portion of epicranial aponeurosis.

Upper and anterior part of helix & upper part of concha. – S. by small occipital branch of cervical plexus.

Attrahens Aurem, or Auricularis Anterior – Lateral prolongation of epicranial aponeurosis below & in front of preceding.

Front part of helix. – S. by facial nerve.

Retrahens Aurem, or Auricularis Posterior – Mastoid process.

Back of concha – S. by auricular branch of facial.

MUSCLES of the NOSE.

MUSCLES of the EYELIDS & ORBIT.

MUSCLES of the MOUTH.

ELEVATOR MUSCLES of the LOWER JAW — Vide following Tablets.

MUSCLES of the FACE—2nd Tablet.

MUSCLES OF THE NOSE.

Pyramidalis Nasi – Continuous superiorly with innermost fibres of occipito-frontalis.
Aponeurosis of compressor nasi.

Compressor Nasi – Lower & inner part of canine fosa.
Aponeurosis continuous with that of its fellow over bridge of nose.

Levator Labii Superioris Alæque Nasi – Upper part of nasal process of superior maxilla.
Cartilage of ala of nose and upper lip blending with orbicularis & levator labii superioris proprius.

Depressor Alæ Nasi – Myrtiform fossa or incisor fossa of upper jaw.
Septum and back part of ala of nose.

Irregular and indistinct fasciculi may be found over the alar cartilages forming the:
Levator Proprius Alæ Nasi Posterior or Dilatator Naris Posterior,
Levator Proprius Alæ Nasi Anterior or Dilatator Naris Anterior,
Compressor Narium Minor.

MUSCLES OF THE EYELIDS.

Orbicularis Palpebrarum – Anterior surface and edges of tendo oculi, internal angular process of frontal, nasal process of superior maxilla in front of lachryma groove.

Orbicular Portion – Thick & red, forms complete ellipses, and blends superiorly with occipito-frontalis and corrugator supercilii.

Palpebral or Ciliary Portion – Thin & pale, forms a series of concentric curves, and is inserted externally into external tarsal ligament & malar bone.

TENDO OCULI OR TENDO PALPEBRARUM – From nasal process of superior maxilla in front of lachrymal groove. Crosses anterior aspect of lachrymal sac giving off a fibrous lamina, the reflected portion of the tendo oculi, which passes backwards & inwards behind lachrymal sac to be attached to ridge on lachrymal bone. Bifurcates and is attached to inner extremity of each tarsal cartilage.

Corrugator Supercilii – Inner extremity of superciliary ridge of frontal.
Under surface of orbicularis & occipito-frontalis.

Tensor Tarsi – Ridge & posterior part of outer surface of lachrymal bone.
Crosses posterior aspect of lachrymal sac, and divides into two slips which are inserted into tarsal cartilages near puncta lachrymalia. – May be considered as a deep part of ciliary portion of orbicularis.

Levator Palpebræ Superioris – Under surface of lesser wing of sphenoid in front of optic foramen and externally to superior oblique.
Upper border of tarsal cartilage.

THE MUSCLES of the FACE—3rd Tablet.

MUSCLES of the ORBIT.

ORIGINS.

Internal & Inferior Recti & Lower Head of External Rectus – Incomplete fibrous ring termed the ligament of Zinn, which surrounds optic foramen, except at its upper & outer part. – Lower head of external rectus also arises from a small spine on orbital surface of greater wing of sphenoid.

Superior Rectus & Upper Head of External Rectus – Upper margin & upper part of outer margin of optic foramen.

Levator Palpebræ Superioris – Under surface of lesser wing of sphenoid in front of optic foramen & externally to superior oblique.

Superior Oblique – Under surface of lesser wing of sphenoid in front of optic foramen & internally to levator palpebræ superioris.

Inferior Oblique – Depression on orbital plate of superior maxilla close to lachrymal groove.

INSERTIONS.

The Four Recti – Fore part of sclerotic about four lines from cornea.

Superior & Inferior Oblique – Upper & outer part of sclerotic between superior & external recti and midway beteen cornea & optic nerve.

Levator Palpebræ Superioris – Upper border of superior tarsal cartilage.

NERVE-SUPPLY — Levator palpebræ superioris & superior rectus, *upper division of 3rd nerve;* – internal & inferior recti and inferior oblique, *lower division of 3rd nerve:* – superior oblique, *4th nerve;* – external rectus, *6th nerve.*

MUSCLES of the FACE—4th Tablet.

MUSCLES of the MOUTH.

Orbicularis Oris – Consists of three portions:

Labial or Marginal Portion – Continued uninterruptedly from one lip to the other round the commissures of the mouth.

Facial Portion – Central fibres decussate with, the others are directly continuous with, fibres of buccinator.

Accessory Portion – Consists for the upper lip of four fasciculi, the musculi accessorii orbicularis superiores, arising from superior maxilla opposite incisor teeth & from septum of the nose; and for lower lip, of two fasciculi, the musculi accessorii orbicularis inferiores, from inferior maxilla near the canine teeth.

Inserted into this muscle and into the integument covering it from the middle of the upper lip to the middle of the lower lip, are the following muscles (the last excepted), which all blend more or less with each other: –

Levator Labii Superioris Alæque Nasi – Upper part of nasal process of superior maxilla.

Levator Proprius Labii Superioris – Superior maxillary & malar bones close to margin of orbit.

Levator Anguli Oris or Musculus Caninus – Canine fossa just below infra orbital foramen.

Zygomaticus Minor – Lower and front part of malar bone.

Zygomaticus Major – Malar bone near zygomatic suture.

Buccinator – Outer surface of alveolar processes of superior & inferior maxillæ corresponding to the molar teeth, and from pterygo-maxillary ligament (which latter is a fibrous band extending from apex of internal pterygoid plate to posterior extremity of mylo-hyoid ridge of lower jaw, and which gives attachment posteriorly to superior constrictor of pharynx).

Its fibres are continuous with those of facial portion of orbicularis oris, the middle ones decussating, the superior & inferior ones passing directly into corresponding lip.

Risorius – Fascia over parotid gland & masseter. – Is often described as the upper par of platysma myoides.

Depressor Anguli Oris or Triangularis Oris – External oblique line of lower jaw externally to mental foramen.

Depressor Labii Inferioris or Quadratus Menti – External oblique line of lowe jaw between symphysis & mental foramen.

Levator Labii Inferioris or Levator Menti – Incisor fossa of lower jaw. Integument of chin close to median line.

MUSCLES of the FACE—5th Tablet.

ELEVATOR MUSCLES of the LOWER JAW.

Masseter.

SUPERFICIAL PORTION – Anterior two-thirds of lower border of zygomatic arch.

Angle & lower half of outer surface of ramus.

DEEP PORTION – Posterior third of lower border & inner surface of zygomatic arch.

Upper half of outer surface of ramus & coronoid process. – S. by anterior or smaller division of inferior maxillary nerve.

Temporal – Whole extent of temporal fossa, except anterior wall, inner surface of temporal fascia.

Apex, inner surface & anterior border of coronoid process down to its root. – S. by anterior or smaller division of inferior maxillary nerve.

Internal Pterygoid – Pterygoid fossa, and more particularly from inner surface of external pterygoid plate, and from groove on pterygoid process of palate bone.

Angle and inner surface of ramus as high as dental foramen. – S. by anterior or smaller division of inferior maxillary nerve.

External Pterygoid.

UPPER HEAD – Pterygoid ridge & portion of under surface of great wing of sphenoid between it and base of pterygoid process.

LOWER HEAD – Outer surface of external pterygoid plate & tuberosity of superior maxillary and palate bones.

Depression on front of neck of condyle & interarticular fibro-cartilage of temporo-maxillary articulation. – S. by anterior or smaller division of inferior maxillary nerve.

MUSCLES of the NECK—1st Tablet.

SUPERFICIAL MUSCLES.

Platysma Myoides – Clavicle, acromion, fascia over pectoralis major, deltoid, & trapezius.

Innermost fibres decussate below chin & in front of symphysis; others are inserted into lower jaw below external oblique line; others blend with depressores labii inferioris & anguli oris and the other muscles of the mouth, forming risorius. – S. by superficial cervical plexus and facial nerve.

Sterno-Cleido-Mastoid or Sterno-Mastoid.

Sternal Portion – Upper & outer part of front of first piece of sternum.

Clavicular Portion – Anterior surface & upper border of inner third of clavicle.

Anterior border & outer surface of mastoid process and outer two-thirds of superior curved line of occipital bone. – S. by deep external branches of cervical plexus & by spinal accessory nerve.

INFRA-HYOID REGION.

Sterno-Hyoid or Sterno-Cleido-Hyoid – Variously from posterior sterno-clavicula ligament, and from upper & back part of first piece of sternum or back o inner extremity of clavicle, or from both; sometimes from clavicle only; occasionally from cartilage of first rib.

Lower border of body of hyoid bone internally to omo-hyoid. – S. by branch from loop between descendens & communicans noni nerves.

Sterno-Thyroid – Back of first piece of sternum below & internally to sterno-hyoid.

Oblique line on ala of thyroid cartilage. – S. by a branch from sam source.

Omo-Hyoid – Upper border of scapula on inner side of suprascapular notch and sometimes from transverse ligament.

Lower border of body of hyoid bone externally to sterno-hyoid. – S. by branch from loop between descendens & communicans noni nerves.

Thyro-Hyoid – Oblique line on ala of thyroid cartilage.

Lower border of body & greater cornu of hyoid bone. – S. by hypoglossal

SUPRA-HYOID REGION.

Digastric – Digastric groove on inner side of mastoid process. – Perforates stylo-hyoi and is held in connection with body & great cornu of hyoid bone by an apo eurotic loop lined with synovial membrane, from which loop it is reflecte upwards & forwards to

Rough depression on inner lip of lower border of jaw bone close to symphysis. – S., posterior belly by facial nerve, anterior belly by mylo-hyoi branch of inferior dental nerve.

Stylo-Hyoid – Middle of outer surface of styloid process.

Body of hyoid bone at its junction with great cornu. – S. by facial nerv

Mylo-Hyoid – Whole length of mylo-hyoid ridge.

Body of hyoid bone & median raphé from hyoid bone to symphysis. – mylo-hyoid branch of inferior dental nerve.

Genio-Hyoid – Inferior genial tubercle.

Anterior surface of body of hyoid bone. – S. by hypoglossal nerve.

MUSCLES of the NECK—2nd Tablet.

ANTERIOR VERTEBRAL REGION.

Rectus Capitis Anticus Major – Anterior tubercles of the transverse processes of the 3rd, 4th, 5th, & 6th cervical vertebræ.

Basilar process in front of rectus capitis anticus minor. – S. by anterior branch of suboccipital nerve & by deep internal branches of cervical plexus.

Rectus Capitis Anticus Minor – Front of the lateral mass of the atlas and root of its transverse process.

Basilar process behind rectus capitis anticus major. – S. by sub-occipital nerve, & by deep internal branches of cervical plexus.

Rectus Lateralis – Upper surface of transverse process of atlas.

Jugular process of occipital bone. – S. by sub-occipital nerve.

Longus Colli.

Superior Oblique Portion – Anterior tubercles of transverse processes of 3rd, 4th, & 5th cervical vertebræ.

Tubercle on anterior arch of atlas.

Inferior Oblique Portion – Front of bodies of two or three upper dorsal vertebræ.

Anterior tubercles of transverse processes of 5th & 6th cervical vertebræ.

Vertical Portion – Front of bodies of lower three cervical & of two or three upper dorsal vertebræ.

Front of bodies of 2nd, 3rd, 4th cervical vertebræ. – S. by one of the supra-clavicular branches of brachial plexus.

LATERAL VERTEBRAL REGION.

Scalenus Anticus – Tubercle on inner border and upper surface of 1st rib.

Anterior tubercles of transverse processes of 3rd, 4th, 5th, & 6th cervical vertebræ. – S. by one of the supra-clavicular branches of brachial plexus.

Scalenus Medius – Upper surface of first rib behind groove for subclavian artery.

Posterior tubercles of transverse processes of six lower cervical vertebræ. S. by one of the supra-clavicular branches of brachial plexus.

Scalenus Posticus – Back of outer surface of 2nd rib.

Posterior tubercles of transverse processes of two or three lower cervical vertebræ. – S. by one of the supra-clavicular branches of brachial plexus.

MUSCLES of UPPER LIMB—1st Tablet.

ANTERIOR THORACIC REGION.

Pectoralis Major – Anterior surface of inner half of clavicle; corresponding half of front of sternum; cartilages of all the true ribs except 1st or 7th or both; aponeurosis of external oblique.

Anterior or outer edge of bicipital groove of humerus. – S. by internal & external anterior thoracic nerves.

Pectoralis Minor – Outer surface & upper border of the 3rd 4th & 5th ribs near their extremities.

Inner border of coracoid process of scapula. – S. by internal anterior thoracic nerve.

Subclavius – Cartilage of first rib in front of rhomboid ligament.

Groove on under surface of middle third of clavicle. – S. by one of the supra-clavicular branches of brachial plexus.

LATERAL THORACIC REGION.

Serratus Magnus – By nine digitations from outer surface & upper border of eight upper ribs (the 2nd rib having two digitations).

Whole length of anterior lip of posterior border of scapula, the two upper digitations being inserted into triangular smooth surface on anterior aspect of superior angle, the three middle digitations into posterior border between superior & inferior angles, and the four lower digitations into anterior aspect of inferior angle. – S. by posterior or long thoracic nerve or external respiratory nerve of Sir C. Bell.

MUSCLES OF THE SHOULDER.

Deltoid – Upper surface & anterior border of outer half of clavicle; upper surface & outer border of acromion; whole length of lower lip of posterior border of spine of scapula.

Rough triangular prominence a little above middle of outer surface of shaft of humerus. – S. by circumflex nerve.

Subscapularis – Inner two-thirds of subscapular fossa; tendinous laminæ attached to ridges of said fossa; aponeurosis which separates it from teres major.

Into lesser tuberosity of humerus and by fleshy fibres into the neck for a short distance lower down. – S. by the two upper subscapular nerves from posterior cord of brachial plexus.

Supraspinatus – Inner two-thirds of supraspinous fossa & fascia which covers it.

Highest of the three facets on greater tuberosity of humerus. – S. by suprascapular nerve.

Infraspinatus – Inner two-thirds of infraspinous fossa & ridges on its surface; fasciæ which separate it from the teres major & minor.

Middle facet on greater tuberosity of humerus. – S. by suprascapular nerve.

Teres Minor – Upper two-thirds of dorsal aspect of axillary border of scapula; intermuscular septa which separate it from infraspinatus & teres major.

Lowest facet on greater tuberosity of humerus and by fleshy fibres into the neck for a short distance lower down – S. by a branch of circumflex nerve.

Teres Major – Dorsal aspect of inferior angle of scapula; intermuscular septa which separate it from infraspinatus & teres minor.

Inner or posterior edge of bicipital groove of humerus. – S. by a branch from lower subscapular nerve.

MUSCLES of UPPER LIMB—2nd Tablet.

ANTERIOR BRACHIAL REGION.

Biceps.

Short Head – Tip of coracoid process of scapula in common with coraco-brachialis.

Long Head – Top of glenoid cavity of scapula & glenoid ligament.

Back part of bicipital tuberosity of the radius. – S. by musculo-cutaneous nerve.

Coraco-brachialis – Tip of coracoid process of scapula in common with short head of biceps.

Rough impression a little above middle of inner surface of shaft of humerus. – S. by musculo-cutaneous nerve.

Brachialis Anticus – Lower half of inner & outer surfaces of shaft of humerus; front of internal & external intermuscular septa.

Under surface of coronoid process of ulna. – S. by musculo-cutaneous & musculo-spiral nerves.

POSTERIOR BRACHIAL REGION.

Triceps.

Long Head – Rough triangular depression below glenoid cavity of scapula, and slightly from capsule of shoulder-joint.

Outer Head – Posterior surface of shaft of humerus above musculo-spiral groove; outer border of humerus; external intermuscular septum.

Inner Head – Posterior surface of shaft of humerus below musculo-spiral groove; inner border of humerus; internal intermuscular septum.

By a strong tendon into back part of upper surface of olecranon process of ulna. – S. by musculo-spiral nerve.

Subanconeus – Posterior surface of humerus above olecranon fossa.

Posterior ligament of elbow joint. – S. by musculo-spiral nerve.

MUSCLES of UPPER LIMB—3rd Tablet.

MUSCLES of FRONT of FOREARM.

SUPERFICIAL LAYER.

Pronator Radii Teres.

LARGE OR SUPERFICIAL HEAD – Inner condyle & inner border of humerus immediately above it, deep fascia of forearm, intermuscular septum between it & flexor carpi radialis.

SMALL OR DEEP HEAD – Ridge on inner surface of coronoid process of ulna below flexor sublimis digitorum.

Rough impression on middle of outer surface of shaft of radius. – S. by median nerve.

Flexor Carpi Radialis – Inner condyle by common tendon; deep fascia; intermuscular septa on either side.

Front of base of 2nd metacarpal bone, & slightly into that of 3rd. – S. by median nerve.

Palmaris Longus – Inner condyle by common tendon; deep fascia; intermuscular septa on either side.

Anterior annular ligament of carpus and palmar fascia. – S. by median nerve.

Flexor Carpi Ulnaris.

ANTERIOR OR INNER HEAD – Inner condyle by common tendon; deep fascia; intermuscular septum between it & palmaris longus.

POSTERIOR OR OUTER HEAD – Inner border of olecranon, and by an aponeurosi which is common to it & to the flexor profundus, from upper two-thirds o posterior border of shaft of ulna.

Pisiform bone and slightly into annular ligament & base of 5t metacarpal bone. – S. by ulnar nerve.

Flexor Sublimis Digitorum.

INNER HEAD – Inner condyle by common tendon, and internal lateral ligament of elbow-joint.

MIDDLE HEAD – Tubercle on inner surface of coronoid process of ulna abov pronator radii teres.

OUTER HEAD – Oblique line on front of radius.

Sides of second phalanges. – S. by median nerve.

DEEP LAYER:

Flexor Profundus Digitorum – Depression on inner side of coronoid proces of ulna, upper two-thirds of anterior & inner surfaces, and, by an aponeurosis which is common to it & to flexor carpi ulnaris, from upper two thirds of posterior border of shaft of ulna; inner half of interosseou membrane.

Bases of third phalanges. – S. partly by ulnar nerve, partly by anterior interosseous branch of median nerve.

Flexor Longus Pollicis – Upper two-thirds of anterior surface of shaft o radius; outer half of interosseous membrane; occasionally by a smal slip from inner side of coronoid process.

Base of last phalanx of thumb. – S. by anterior interosseous branc of median nerve.

Pronator Quadratus – Lower fourth of anterior surface & inner border o ulna; aponeurosis which covers inner third of the muscle.

Lower fourth of anterior surface & outer border of radius. – S. b anterior interosseous branch of median nerve.

MUSCLES of UPPER LIMB—4th Tablet.

MUSCLES of OUTER SIDE of FOREARM.

Supinator Longus – Upper two-thirds of external condyloid ridge of humerus, external intermuscular septum.

Outer side of base of styloid process of radius. – S. by musculo-spiral n.

Extensor Carpi Radialis Longior – Lower third of external condyloid ridge of humerus, external intermuscular septum.

Back of base of second metacarpal bone. – S. by musculo-spiral nerve.

Extensor Carpi Radialis Brevior – External condyle of humerus by a tendon common to it & to superficial muscles of back of forearm; external lateral ligament of elbow-joint; deep fascia; intermuscular septa on either side.

Back of base of third metacarpal bone. – S. by posterior interosseous n.

MUSCLES of BACK of FOREARM.

SUPERFICIAL LAYER.

Extensor Communis Digitorum – External condyle of humerus by the common tendon; deep fascia; intermuscular septa on either side.

Bases of 2nd & 3rd phalanges of the four fingers. – S. by posterior interosseous nerve.

Extensor Minimi Digiti – External condyle of humerus by the common tendon; deep fascia; intermuscular septa on either side.

Joins corresponding tendon of extensor communis. The common tendon thus formed is inserted into bases of 2nd & 3rd phalanges of little finger. – S. by posterior interosseous nerve.

Extensor Carpi Ulnaris – External condyle of humerus by the common tendon; middle third of posterior border of shaft of ulna; deep fascia; septum between it & foregoing muscle. Usually it simply covers, but sometimes it arises from, narrow portion of posterior surface of shaft of ulna internal to the vertical ridge.

Base of metacarpal bone of little finger. – S. by posterior interosseous n.

Anconeus – Back of outer condyle of humerus; deep fascia.

Rough triangular surface on outer side of olecranon & upper third of shaft of ulna. – S. by musculo-spiral nerve.

DEEP LAYER.

Supinator Brevis – External condyle of humerus; external lateral ligament of elbow-joint; orbicular ligament of radius; triangular depression below lesser sigmoid cavity & ridge behind the depression.

Inner, anterior, and outer aspects of radius above bicipital tuberosity & oblique line as low down as insertion of pronator radii teres. – S. by posterior interosseous nerve.

Extensor Ossis Metacarpi Pollicis – Outer half of posterior surface of shaft of ulna below insertion of anconeus; posterior surface of interosseous membrane; middle third of posterior surface of shaft of radius.

Base of first metacarpal bone. – S. by posterior interosseous nerve.

Extensor Primi Internodii Pollicis – Posterior surface of radius below foregoing muscle; interosseous membrane.

Base of first phalanx of thumb. – S. by posterior interosseous nerve.

Extensor Secundi Internodii Pollicis – Middle of outer half of posterior surface of shaft of ulna; posterior surface of interosseous membrane.

Base of terminal phalanx of thumb. – S. by posterior interosseous nerve.

Extensor Indicis – Posterior surface of shaft of ulna below foregoing muscle; interosseous membrane.

Joins corresponding tendon of extensor communis. The common tendon thus formed is inserted into bases of 2nd & 3rd phalanges of index finger. – S by posterior interosseous nerve,

MUSCLES of PALM of HAND.

MUSCLES of the THENAR EMINENCE or MS. of the THUMB

Abductor Pollicis or Trapezo-phalangeal – Ridge on anterior surface of trape zium & anterior annular ligament of wrist.
Outer side of base of first phalanx of thumb. – S. by median nerve.

Opponens Pollicis or Trapezo-metacarpal – Front of trapezium below the ridg & annular ligament.
Whole length of outer border of metacarpal bone of thumb. – S. by median

Flexor Brevis Pollicis or Trapezocarpo-phalangeal.
Outer or Superficial Head – Lower part of trapezium & anterior annular ligamen
Inner or Deep Head – Trapezoides, os magnum, base of 2nd & 3rd metacarpal bone
Either side of base of first phalanx of thumb, a sesamoid bone being deve loped in each tendon. – S. by median nerve, & deep branch of ulnar.

Adductor Pollicis or Metacarpo-phalangeal – Lower two-thirds of anterior su face of 3rd metacarpal bone.
Inner side of base of first phalanx of thumb. – S. by deep branch of ulnar

MS. of HYPO-THENAR EMINENCE or MS. of LITTLE FINGER

Palmaris Brevis – Annular ligament & inner edge of central palmar fascia.
Skin over inner border of hand. – S. by superficial branch of ulnar nerv

Abductor Minimi Digiti, or Pisi-phalangeal – Pisiform bone, and slightly fro tendon of flexor carpi ulnaris.
Inner side of base of first phalanx of little finger. – S. by deep branch ulnar nerve.

Flexor Brevis Minimi Digiti, or Unci-phalangeal – Unciform process unciform bone & annular ligament.
Inner side of base of first phalanx of little finger. – S. by deep branch ulnar nerve.

Opponens or Adductor Minimi Digiti, or Unci-metacarpal* – Uncifor process of unciform bone & annular ligament.
Whole length of inner border of metacarpal bone of little finger. – S. deep branch of ulnar nerve.

*These names, expressive of the origin & insertion of the corre ponding muscles, are due to Cruveilhi

MUSCLES of the CENTRAL PALMAR REGION.

Lumbricales – First, and sometimes Second, from outer side of corresponding de flexor tendon. – Third and Fourth, from adjoining sides of 2nd & 3rd and 3 & 4th deep flexor tendons respectively.
Outer side of expansion of corresponding extensor tendon on back first phalanges. – S., the two outer by median nerve; the two inner by de branch of ulnar nerve.

Palmar Interossei – Three. – They arise from the whole length of one side of the me carpal bone of one finger, and are inserted into the same side of the base of t first phalanx of the same finger & into the expansion of the extensor tend which covers it. – They are situated respectively on the inner side of the 2 metacarpal bone & index finger, and on the outer side of the 4th & 5th me carpal bones and corresponding ring & little fingers. They adduct these fing towards an imaginary line drawn through the long or middle finger. – Th are supplied by the deep branch of the ulnar nerve.

Dorsal Interossei – Four – They arise by two heads from the adjacent sides of t metacarpal bones, but more extensively from the side of that metacarpal bo which corresponds to the finger into which the muscle is inserted. They inserted into the corresponding side of the base of the first phalanx of the c responding finger & into the expansion of the corresponding extensor tendo They are situated respectively on the outer side of the 2nd metacarpal bon index finger, on both sides of the 3rd metacarpal bone & middle finger, on inner side of the 4th metacarpal bone & ring finger. The 1st dorsal interosse muscle is larger than the others, and is sometimes called the abductor indi the radial artery passes between its two heads. – They abduct the fingers fr an imaginary line drawn through the long or middle finger. – They are suppl by the deep branch of the ulnar nerve.

USCLES of the THORAX.

External Intercostals – Eleven pairs. Downwards & forwards from lower border of eleven upper ribs to upper border of eleven lower ribs.

Commence posteriorly at or near tubercle of each rib. In the six upper intercostal spaces they extend anteriorly to near outer end of costal cartilages; in three following spaces they are prolonged some distance between the cartilages; in the two last spaces they extend to the end of the space. When not prolonged to end of the space they are continued up to sternum by thin tendinous fibres having the same direction as the muscular fibres.

Internal Intercostals – Eleven pairs. Upwards & forwards from upper border of eleven lower ribs to inner lip of groove on inner surface of each rib above, & to inner surface of costal cartilages.

Commence anteriorly at anterior extremity of costal cartilages, being continuous, in the two lowest intercostal spaces with fibres of internal oblique. End posteriorly at or near angle of ribs, approaching nearest to spine in the upper & the lower spaces.

Subcostales or Infracostales – Upwards & forwards from inner surface of one rib to inner surface of first, second, or third rib above. Vary in size & number, and are most numerous between the lower ribs, and in the neighbourhood of their angles.

Levatores Costarum or Supracostales – Twelve. From tips of transverse processes of seventh cervical & eleven first dorsal vertebræ to upper rough border of rib below, between tubercle & angle, and, in the case of the few lower, to corresponding part of the second rib below origin.

Triangularis Sterni – Radiates from lower & lateral parts of posterior surface of sternum, and from ensiform cartilage & cartilages of three or four lower true ribs, to inner surface & lower border of cartilages of second, third, fourth, & fifth ribs, the lowest fibres being continuous with those of transversalis. Varies considerably in different bodies, and even on opposite sides of same body.

Rectus Sternalis – An occasional prolongation, fleshy in middle & tendinous at both ends, of rectus abdominis in front of pectoralis major. Inserted superiorly into sternum in connection with tendon of sterno-mastoid; rarely present on both sides.

N. — All these muscles are supplied by the intercostal nerves.

MUSCLES of the ABDOMEN.

External Oblique – Outer surface & lower borders of the *eight lower ribs*, interdigitating by four or five slips with serratus magnus & by three or four with latissimus dorsi.

By fleshy fibres into anterior half of outer lip of crest of ilium, and its aponeurosis forms in succession:

Poupart's ligament;
Gimbernat's ligament;
Outer pillar of external abdominal ring;
Inner pillar of external abdominal ring:
Superficial part of linea alba by decussating with its fellow, and perhaps also after decussating the
Triangular ligament & intercolumnar fascia of opposite side. (Vide abdominal Aponeuroses)

* **Internal Oblique** – Outer half of Poupart's ligament; anterior two-thirds of middle lip of crest of ilium; posterior layer of lumbar fascia.

Lower border of *cartilages of four lower ribs*; linea alba; crest of pubes & pectineal line behind Gimbernat's ligament to the extent of about ½ an inch, forming part of the conjoined tendon.

Transversalis – Outer third of Poupart's ligament; anterior three-fourths of inner lip of crest of the ilium; inner surface of *cartilages of six lower ribs* interdigitating with Diaphragm; by lumbar fascia from tips of spinous processes, tips & bases of transverse processes of all the lumbar vertebræ.

Linea alba; crest of pubes & pectineal line behind Gimbernat's ligament to the extent of about ½ an inch, forming part of the conjoined tendon.

Rectus Abdominis – By two heads from crest of pubes & ligamentous fibres covering symphysis.

Cartilages of 5*th*, 6*th* & 7*th* ribs & side of ensiform cartilage.

This muscle is traversed by from 3 to 5 *lineæ transversæ*, irregular tendinous intersections, which interrupt the superficial fibres and adhere firmly t anterior wall of sheath; these are situated opposite umbilicus, between umbilicu & ensiform cartilage, and, frequently, one or two less complete ones, near o below umbilicus.

Pyramidalis – Front of pubes & anterior pubic ligament.

Linea alba midway between pubes & umbilicus. – Is often absent on on or both sides.

Cremaster – From middle of Poupart's ligament internally to lowest fibres of interna oblique & transversalis, and by a small pointed tendon from front of pubes sheath of rectus, forming large external, and smaller & less constant interna bundles. Is the everted gubernaculum testis with a few additional fibres of th internal oblique, and sometimes of the transversalis, drawn or pushed down b the testicle during its descent (Curling).

Quadratus Lumborum.

Anterior Portion – Upper border of transverse processes of the two or three lowe lumbar vertebræ.

Inner half of lower border of last rib.

Posterior Portion – Ilio-lumbar ligament, and for about 2 or 3 inches from posterior part of inner lip of crest of ilium.

Apices of transverse processes of the 4 upper lumbar vertebræ, and inne half of lower border of last rib,

N.—These muscles are supplied by the lower intercostal, ilio-hypogastric, ilio-inguinal nerves. The quadratus lumborum also receive branches from the anterior divisions of the lumbar nerves.

THE DIAPHRAGM

Is fan-shaped; the expanded portion of the fan being horizontal, and the narrow portion or handle, vertical. It presents for examination its points of origin & the fibres arising from them, its central or cordiform tendon, its openings, & its relations.

POINTS OF ORIGIN & FIBRES ARISING FROM THEM:

Ensiform Cartilage – Gives attachment to a narrow & sometimes tendinous slip, on either side of which the costal cartilages & the costal fibres bound a narrow triangular area, over the extent of which area the pleuræ & the peritoneum are separated only by a little areolar tissue.

Cartilages & Osseous Portions of the 6 or 7 Lower Ribs – Give rise to the long arched lateral fibres, which, at their point of origin, interdigitate with the transversalis.

Ligamentum Arcuatum Internum – A thickened band of the fascia over the psoas, extending from side of body of 1st, & sometimes from that of 2nd lumbar vertebra, to tip of transverse process of 1st & sometimes to that of 2nd. Gives rise to arched fibres similar but rather shorter.

Ligamentum Arcuatum Externum – A thickened band of the fascia over quadratus lumborum (anterior lamella of posterior abdominal aponeurosis), extending from tip of transverse process of first lumbar vertebra, & sometimes from that of 2nd, to lower border & apex of last rib. Gives rise to similar arched fibres.

Bodies of Second, Third & Fourth Lumbar Vertebræ by means of the

CRURA — Two thick fibro-muscular bundles, which arise by tendinous fibres as follows:

Right Crus – The thickest & longest, from front of bodies & intervertebral substances of 1st, 2nd, & 3rd, or sometimes of 2nd, 3rd, & 4th lumbar v., & from ant. common ligt. of spine.

Left Crus – The shortest & narrowest, from left side of bodies & intervertebral substances of 1st & 2nd or sometimes of 2nd & 3rd lumbar vertebræ, & from ant. common ligt. of spine.

The tendons ascend for a short distance on either side of the aorta, and then become joined in front of that vessel by means of a tendinous arch formed by the blending of their innermost fibres. The crura then give rise, as well as the intervening arch to two large fleshy bellies, the outer fasciculi of which bellies pass upwards & outwards to the cordiform tendon, while the inner ones first decussate in front of the aorta (those of the right side being the largest & most anterior), then diverge to surround the œsophagus, and finally meet again in front of it before they end in the central tendon. (In some very rare cases these fasciculi do not join in front of the œsophagus, a portion of the anterior margin of the œsophageal opening is then tendinous).

CENTRAL or CORDIFORM TENDON

— The common insertion of all the fibres. Has somewhat the shape of a trefoil leaf; and presents anteriorly three leaflets; the right one is long, broad, & the largest; the left one, long, narrow, & the smallest; the middle one short, broad, & intermediate in size.

OPENINGS — Are:

Large Openings – Three:

Aortic Opening – For aorta, vena azygos major, thoracic duct & frequently the left cord of the sympathetic. Lies in middle line, and is osteo-fibrous, being bounded behind by bodies of vertebræ, laterally by tendons of the crura, and in front by the fibrous arch which joins the latter.

Œsophageal Opening – For œsophagus & pneumogastric nerves. Lies higher up, & a little to the left. Is oval in form & entirely muscular, being formed by the inner decussating fasciculi of the fleshy portion of the crura; – in some very rare cases a portion of the anterior margin is fibrous, & formed by the posterior border of cordiform tendon.

Opening for Inferior Vena Cava – The highest; lies a little to the right between right & middle leaflets of cordiform tendon. Is quadrilateral & fibrous, being bounded by four bundles of tendinous fibres which meet at right angles.

Small Openings – Transmit;

Right cord of sympathetic, & sometimes the left;
Right & left great, lesser, & least splanchnic nerves, either separately or conjointly.
Vena azygos minor, & sometimes the major – These openings vary therefore in number.

RELATIONS —

Of Upper Surface:

Laterally – Pleuræ; lungs. Also at circumference of thorax for a considerable though variable extent, lower ribs & lower intercostal spaces, the lungs not descending under ordinary circumstances as low as the costal attachments of the diaphragm & the point of reflection of the pleuræ The lateral portions of the diaphragm are the most movable; their degree of elevation or depression varies much more than that of the central part in accordance with the respiratory movements, and with the degree of distension, or otherwise, of the stomach, intestines, & uterus. The right lateral portion of the diaphragm, on account of the pressure of the liver on that side, rises by one or two ribs' breadths higher than the left, and reaches the level of

In Forced Expiration – 4th costal cartilage;
In State of Repose of Thorax – 5th costal cartilage;
In Forced Inspiration – Line from ensiform cartilage, to back of 10th rib.

Centrally – Heart & base of pericardium, the fibrous layer of which latter sac blends more particularly with the anterior & left part of central leaflet of cordiform tendon, & with the fascia covering the left anterior costal fibres. The central part of the diaphragm is flattened & less movable, and lies on a lower level than the lateral portions, except close to the sternum, in front, & to the vertebræ, behind, where, on the contrary, it rises a little higher.

Of Under Surface – This is entirely covered by peritoneum except behind pancreas, kidneys & suprarenal capsules, and at points of attachment of coronary & lateral ligaments of liver, gastro-phrenic ligament, & suspensory ligament of spleen; it lies in mediate contact with liver, stomach & spleen.

The diaphragm is supplied by the phrenic nerves & the phrenic plexuses of the sympathetic.

SUPERFICIAL MUSCLES of the BACK.

FIRST LAYER.

Trapezius - External occipital protuberance & inner third of superior curved line of occipital bone; ligamentum nuchæ & spinous processes of the last cervical & of al the dorsal vertebræ; supraspinous ligament.

Posterior border of outer third of clavicle, inner border of acromion; whole length of upper lip of posterior border of spine of scapula, and tubercle at outer part of smooth surface at its inner extremity. - S. by spinal accessory nerve & deep branches of cervical plexus.

Latissimus Dorsi - Spinous processes of the 6 or 7 lower dorsal vertebræ; by th posterior layer of lumbar aponeurosis, from the lumbar & sacral spines and the back part of outer lip of crest of ilium; from outer lip of crest of ilium fo an inch or more in front of lumbar aponeurosis; from the last three or four rib interdigitating with external oblique; sometimes by a few fibres from inferio angle of scapula.

Bottom of bicipital groove of humerus a little higher up than teres major by a broad flat tendon twisted upon itself. - S. by long subscapular nerve.

SECOND LAYER.

Levator Anguli Scapulæ - Posterior tubercles of transverse processes of the 3, 4, or upper cervical vertebræ between splenius & scalenus medius.

Posterior border of scapula between spine & superior angle. - S. by one o the deep branches of the cervical plexus and by one of the supra-clavicula branches of the brachial plexus.

Rhomboideus Minor - Ligamentum nuchæ and spinous processes of 7th cervical & 1s dorsal vertebræ.

Posterior border of scapula opposite triangular smooth surface at root o spine. - S. by one of the deep branches of cervical plexus and by one of the supra-clavicular branches of the brachial plexus.

Rhmoboideus Major - Spinous processes of the 4 or 5 upper dorsal vertebræ and supra spinous ligament.

Base of scapula between spine and inferior angle (Quain, Ellis), or rathe into a tendinous arch attached to the triangular smooth surface at root o spine & to the inferior angle and connected to posterior border of scapula b a thin membrane (Gray). - S. by one of the deep branches of the cervica plexus and by one of the supra-clavicular branches of the brachial plexus.

THIRD LAYER.

Splenius - Lower half of ligamentum nuchæ and spinous processes of 7th cervical & si upper dorsal vertebræ.

Splenius Capitis - Mastoid process and outer part of rough surface between superior & inferior curved lines of occipital bone.

Splenius Colli - Posterior tubercles of transverse processes of the 2, 3, or 4 upper cervical vertebræ. - S. by external branches of posterior divisions of cervical nerve

Serratus Posticus Superior - Ligamentum nuchæ and spinous processes of 7th cervical & two or three upper dorsal vertebræ, and interspinous ligament.

Upper border of 2nd, 3rd, 4th & 5th ribs a little beyond their angle. - S by external branches of posterior divisions of lower cervical nerves.

Serratus Posticus Inferior - Spinous processes of the two last dorsal & 2 or 3 uppe lumbar vertebræ.

Lower border of 4 lower ribs a little beyond their angle. - S. by externa branches of posterior divisions of lower dorsal nerves.

EEP MUSCLES of the BACK—Classification.

May be divided into:

LONG EXTENSOR MUSCLES of the BACK –

Lie beneath the trapezius, the latissimus dorsi & the superficial layer of the lumbar fascia, and beneath the splenius & a special layer of fascia in the neck, & the serrati muscles & the vertebral aponeurosis in the back.

They form a large elongated muscular and tendinous mass, narrow & principally tendinous and comprised in the sacral groove, below; enlarged & fleshy in the lumbar region, where it is only partly contained in the vertebral groove, and is tightly sheathed between the spines, laminæ, & transverse processes of the vertebræ and the posterior & middle layers of the lumbar fascia; expanded and complexly subdivided into almost innumerable muscular and tendinous fasciculi in the back; and, in the cervical region, partly exhausted, but continued upwards towards the head by numerous superadded fibres, & also strengthened by an additional muscle, the complexus.

The muscular & tendinous slips of which this mass is composed may be correctly and conveniently arranged into three main groups forming respectively the *ilio-costalis or sacro-lumbalis*, the *longissimus dorsi*, & the *multifidus spinæ*; the two former of which, joined together below, and increased by a few additional fibres, the spinalis dorsi, form the *erector spinæ* of the sacral & lumbar regions. (The term "*erector spinæ*" would be much better applied to the whole of the long extensor muscles of the back than to any one part thereof).

Each of these three groups has additional fasciculi superadded to it, by which fasciculi it is continued to the head or to near the head, and by which it is increased in bulk & strength. Thus to the

ILIO-COSTALIS OR SACRO-LUMBALIS are superadded the
Musculus accessorius ad ilio-costalem (or ad sacro-lumbalem) & the *cervicalis ascendens*; – to the

LONGISSIMUS DORSI are superadded the
Transversalis colli & the trachelo-mastoid; – to the

MULTIFIDUS SPINÆ are superadded the
Semispinales dorsi & colli & the *rotatores spinæ*.

To these groups are also added a few accessory fasciculi, the *spinalis dorsi*, the *spinalis colli*, & the *biventer cervicis*.

SMALL MUSCLES of the SPINOUS & TRANSVERSE PROCESSES — Are the

Supraspinales, interspinales, intertransversales, & extensor coccygis.

SHORT POSTERIOR CRANIO-VERTEBRAL MUSCLES — Are the

Recti capitis postici major & minor, & the *Obliqui superior & inferior.*

LONG EXTENSOR MUSCLES of the BACK—1st Tablet.

The ilio-costalis or sacro-lumbalis & the longissimus dorsi arise by a common origin the erector spinæ

ERECTOR SPINÆ — Posterior fifth of crest of ilium; and, by a broad thick tendo which covers and conceals the muscular fibres, from spines of sacrum, th spinous processes of the lumbar & three lower dorsal vertebræ, the posterio superior & posterior inferior iliac spines, and the series of eminences on bac of sacrum, which eminences represent the transverse processes of the vertebræ Divides opposite last rib into ilio-costalis or sacro-lumbalis & longissimus dorsi.

ILIO-COSTALIS, or SACRO-LUMBALIS — Is the outer and smaller divisio of the foregoing, and is inserted into the
Angles of the six or seven lower ribs.

Musculus Accessorius ad Ilio-costalem, or ad Sacro-lumbalem - Angle of the six lower ribs internally to tendons of ilio-costalis.
Angles of the six upper ribs.

Cervicalis Ascendens - Angles of the four or five upper ribs.
Posterior tubercles of transverse processes of 4th, 5th, & 6th cervical vertebræ.

LONGISSIMUS DORSI — Is the inner & largest division of the erector spinæ Has two series of insertions both in the lumbar & the dorsal regions:

INNER SERIES OF INSERTIONS - Tubercles (mammillary) on back of superior articular processes of the lumbar vertebræ, & tips of the transverse processes of al the dorsal vertebræ.

OUTER SERIES OF INSERTIONS - Posterior surfaces of transverse processes of th lumbar vertebræ, & nine or ten lower ribs internally to their angles.

Transversalis Colli - Tips of transverse processes of the four or five highest dorsal vertebræ.
Posterior tubercles of transverse processes of the five lower cervical vertebræ.

Trachelo-Mastoid - Transverse process of the five upper dorsal vertebræ, an articular processes of the three or four lower cervical.
Posterior border of mastoid process beneath splenius & sterno-mastoid.

SPINALIS DORSI — Spinous processes of the first two lumbar and last tw dorsal vertebræ.
Spinous process of from four to eight of the middle & upper dorsal vertebræ. - Is intimately connected with the longissimus dorsi, of which it may be considered as the innermost part (Cruveilhier); the longissimus dorsi then having three series of insertions, middle, outer, & inner.

All the foregoing muscles are supplied by the external branches of the posterior divisions of the cervical, dorsal & lumbar nerves.

MULTIFIDUS SPINÆ — (Vide next Tablet.)

ONG EXTENSOR MUSCLES of the BACK—2nd Tablet.

MULTIFIDUS SPINÆ — Is the innermost and deepest portion of the musculo-tendinous mass of the long extensor muscles of the back.

It lies in the vertebral groove beneath the erector spinæ and the longissimus dorsi, and extends along the whole length of the spine connecting the lateral to the postero-median processes of the vertebræ from the sacrum to the axis.

It is reinforced in the upper dorsal & cervical regions by the semispinales dorsi & colli, which may fairly be considered as its accessory fibres.

Its origins are homologous in the several regions of spine; they are as follows:

Sacral Region – Sacral groove and deep surface of tendon of erector spinæ; posterior superior spine of ilium & posterior sacro-iliac ligament.

Lumbar Region – Tubercles (mammillary) on back of superior articular processes.

Dorsal Region – Tips of transverse processes.

Cervical Region – Articular processes of the four lower cervical vertebræ.

Its insertions are into the whole series of the spinous processes and the adjoining portion of the laminæ; the length of the individual fasciculi varying, some joining contiguous vertebra, others passing up to the 2nd, 3rd, or 4th vertebra above.

Semispinales Muscles – Are additional muscles superadded to the preceding, on the surface of which they lie.

Semispinalis Dorsi – Transverse processes of the middle dorsal vertebræ from the 10th to the 5th.

Spinous processes of the four upper dorsal & two last cervical vertebræ.

Semispinalis Colli – Transverse processes of the four upper dorsal vertebræ.

Spinous processes of the cervical vertebræ from the axis to the 5th.

Rotatores Spinæ – Eleven pairs; lie in the dorsal region beneath the multifidus spinæ, of which they form the deepest fibres. – Upper & back part of transverse processes.

Lower margin & posterior surface of laminæ, and roots of spinous processes.

COMPLEXUS — Transverse processes of the four or five upper dorsal and last cervical vertebræ; articular processes of the three or four cervical vertebræ above.

Innermost rough depression between the two curved lines of the occipital bone. – Has a tendinous intersection a little above its middle.

Biventer Cervicis – Is but the inner part of preceding muscle. – Transverse processes of the two, three or four upper dorsal vertebræ.

Occipital bone on inner side of preceding.

SPINALIS COLLI — Similar to spinalis dorsi, and as intimately connected with the complexus as is the latter with the longissimus dorsi. – Spinous processes of the one or two last cervical & the one or two upper dorsal vertebræ.

Spinous processes of the axis and of one or two vertebræ below. – Is often wanting.

All the foregoing muscles are supplied by the internal branches of the posterior divisions of the cervical, dorsal, & lumbar nerves; the complexus is also supplied by the suboccipital & great occipital nerves.

SHORT POSTERIOR CRANIO-VERTEBRAL MUSCLES.

Rectus Capitis Posticus Major – Spinous process of axis.
Into and beneath outer part of inferior curved line of occipital bone.

Rectus Capitis Posticus Minor – Tubercle on posterior arch of atlas.
Into and beneath inner part of inferior curved line of occipital bone.

Obliquus Capitis Inferior – Spinous process of axis.
Extremity of transverse process of atlas.

Oblquus Capitis Superior – Extremity of transverse process of atlas.
Occipital bone between the two curved lines externally to the complexus & rectus capitis posticus major.

These muscles are supplied by the posterior branch of the suboccipital nerve; the inferior oblique is also supplied by the great occipital nerve.

SMALL MUSCLES of the SPINOUS & TRANSVERSE PROCESSES.

Supraspinales – Small fleshy fasciculi which lie on the cervical spinous processes.

Interspinales – Short fleshy fasciculi placed in pairs between the spinous processes of the adjoinng vertebræ. – There are six pretty distinct pairs corresponding to the six lower cervical vertebræ; four pairs corresponding to the lumbar vertebræ; sometimes two or three rather indistinct pairs corresponding to the upper and lower dorsal vertebræ.

Intransversales – Short fleshy fasciculi which lie between the transverse processes of the adjoining vertebræ. – Are most developed in the cervical region, where they form seven pairs; they are tendinous in the upper part of the dorsal region; muscular, but single in lumbar region & in lower part of dorsal.

These muscles are supplied, the two former by the internal, the latter by the external branches of the posterior divisions of the cervical dorsal & lumbar nerves.

IUSCLES of LOWER LIMB—1st Tablet.

ILIAC REGION.

Psoas Magnus – Bases of transverse processes of lumbar vertebræ, and by five slips from sides of bodies of lumbar & last dorsal vertebræ & from corresponding intervertebral substances; the slips being connected by tendinous arches which extend across the constricted part of the bodies of the vertebræ.

Lesser trochanter of femur. – S. by anterior branches of lumbar nerves.

Psoas Parvus – Sides of bodies of last dorsal & first lumbar vertebræ & corresponding intervertebral substance.

Ilio-pectineal eminence. – S. by anterior branches of lumbar nerves. – Is frequently absent.

Iliacus – Iliac fossa & inner lip of crest of ilium; ilio-lumbar ligament; base of sacrum; anterior superior & anterior inferior spines of ilium & notch between them; capsule of hip-joint.

Outer side of tendon of psoas, and upper part of line from lesser trochanter to linea aspera in front of pectineus. – S. by anterior crural nerve.

ANTERIOR FEMORAL REGION.

Tensor Vaginæ Femoris – Anterior superior spinous process and anterior part of outer lip of crest of ilium.

Fascia lata about ¼ down outer side of thigh. – S. by superior gluteal nerve.

Sartorius – Anterior superior spinous process of ilium & upper half of notch below it.

Upper part of inner surface of shaft of tibia covering tendons of gracilis & semitendinosus. – S. by middle or internal cutaneous branch of anterior crural nerve.

Rectus Femoris – Anterior inferior spinous process of ilium (straight tendon); groove above brim of acetabulum (reflected tendon).

Upper border of patella in common with vasti & crureus. – S. by anterior crural nerve.

Vastus Externus – Anterior border of great trochanter & horizontal ridge on its outer surface; rough line from great trochanter to linea aspera; whole length of outer lip of linea aspera & line from linea aspera to outer condyle; external intermuscular septum.

Outer border of patella & slightly into head of tibia. – S. by anterior crural nerve.

Vastus Internus – Line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; inner surface of femur; internal intermuscular septum.

Inner border of patella & slightly into head of tibia. – S. by anterior crural nerve.

Crureus – Anterior & outer surfaces of femur reaching from anterior intertrochanteric line to within a few inches of condyles.

Upper border of patella in common with rectus & vasti. – S. by anterior crural nerve.

Taking the vastus internus & the crureus as forming but one muscle, and describing the *Quadriceps extensor femoris* as a *Triceps*, we may say that the "VASTUS INTERNUS" arises from: – line from inner side of neck of femur to linea aspera; whole length of inner lip of linea aspera & line from linea aspera to inner condyle; nearly whole of *inner*, *anterior* and *outer* surfaces of shaft of femur; internal intermuscular septum; – and that it is inserted into tendon of rectus & borders of patella, and slightly into head of tibia.

Subcrureus – Lower part of anterior surface of femur.

Upper part of synovial membrane of knee-joint. – S. by anterior crural nerve.

MUSCLES of LOWER LIMB—2nd Tablet.

INTERNAL FEMORAL REGION.

Pectineus – Ilio-pectineal line & surface in front of it.
Upper part of line from trochanter minor to linea aspera, & into fem behind trochanter minor. – S. by obturator or anterior crural nerve; – by acce sory obturator nerve when the latter exists.

Gracilis – Inner margin of rami of pubes & ischium & lower half of inner margin of bo of pubes.
Upper part of inner surface of shaft of tibia above semitendinosus, a beneath sartorius. – S. by obturator nerve.

Adductor Longus – Front of pubes immediately below the crest & close to angle.
Middle third of inner lip of linea aspera between vastus internus & a ductor magnus. – S. by obturator nerve.

Adductor Brevis – Front of pubes for about two inches below adductor longus between gracilis & obturator externus.
Upper part of linea aspera & lower part of line from it to lesser trocha ter below & behind pectineus. – S. by obturator nerve or anterior crural nerve.

Adductor Magnus – Lower part of descending ramus of pubes; ascending ramus outer side of tuberosity of ischium.
Lower part of line from great trochanter to linea aspera, whole length inner lip of linea aspera & line from it to inner condyle; by a strong tendo into tubercle at upper & back part of inner condyle. – S. by obturator & grea sciatic nerves.

IUSCLES of LOWER LIMB—3rd Tablet.

GLUTEAL REGION.

Gluteus Maximus – Superior curved line on dorsum ilii & rough surface between it & posterior fifth of crest of ilium; sides of lower part of sacrum and coccyx & tendinous expansion over back of sacrum; posterior surface of great sacro-sciatic ligament.

Fascia lata covering outer side of thigh, & rough line from great trochanter to linea aspera. – S. by inferior gluteal nerve.

Gluteus Medius – Dorsum ilii between superior & middle curved lines & outer lip of crest between them; fascia covering anterior part of the muscle.

Oblique line on outer surface of great trochanter. – S. by superior gluteal nerve.

Gluteus Minimus – Dorsum ilii between middle & inferior curved lines.

Anterior border of great trochanter. – S. by superior gluteal nerve.

Pyriformis – By three fleshy digitations from front of sacrum between first, second, third, & fourth anterior sacral foramina & from grooves leading from them; margin of great sacro-sciatic foramen & anterior surface of great sacro-sciatic ligament.

Posterior part of upper border of great trochanter. – S. by one of the muscular branches of sacral plexus.

Obturator Internus – Whole of inner surface of true pelvis in front of and behind obturator foramen; inner surface of obturator membrane & fibrous arch which completes canal for obturator vessels & nerve.

Upper border of great trochanter in front of pyriformis. – S. by one of the muscular branches of sacral plexus.

Gemellus Superior – Outer surface of spine of ischium.

Upper part of tendon of obturator internus. – S. by one of the muscular branches of sacral plexus.

Gemellus Inferior – Upper part of outer lip of tuberosity of ischium.

Lower border of tendon of obturator internus. – S. by one of the muscular branches of sacral plexus.

Quadratus Femoris – Outer border of tuberosity of ischium.

Upper part of linea quadrati on back of great trochanter. – S. by one of the muscular branches of sacral plexus.

Obturator Externus – Inner two-thirds of outer surface of obturator membrane; circumference of obturator foramen, and fibrous arch which completes canal for obturator vessels & nerve.

Digital fossa of femur. – S. by obturator nerve.

MUSCLES of LOWER LIMB—4th Tablet.

POSTERIOR FEMORAL REGION (Hamstring Muscles).

iceps.

Long Head – In common with semitendinosus from lower & inner of the two su faces on back part of tuberosity of ischium.

Short Head – Whole length of outer lip of linea aspera between adductor magn & vastus externus and from inferior external division of linea aspera to with two inches of outer condyle.

Outer side of head of fibula by a strong tendon, which divides into t parts to embrace long external lateral ligament of knee-joint, sends a fibro prolongation to outer tuberosity of tibia, and gives off an expansion to fascia leg. – S. by great sciatic nerve.

Semitendinosus – In common with long head of biceps from lower & inner of the t surfaces on back part of tuberosity of ischium.

Upper part of inner surface of shaft of tibia below gracilis & beneath s torius – S. by great sciatic nerve.

Semimembranosus – Upper and outer of the two surfaces on back part of tuberosi of ischium above & on outer side of origin of biceps & semitendinosus.

By a tendon which divides into three portions, into:

Posterior part of inner tuberosity of tibia, sending an expansion o poplite

Groove on inner side of inner tuberosity of tibia beneath inter lateral ligament of knee-joi

Posterior & upper part of outer condyle of femur, forming chief p of posterior ligament of knee-joint. – S. by great sciatic ner

MUSCLES of LOWER LIMB—5th Tablet.

ANTERIOR TIBIO-FIBULAR REGION.

Tibialis Anticus – Outer tuberosity & upper two-thirds of outer surface of shaft of tibia; adjoining part of the interosseous membrane; intermuscular septum between it & extensor longus digitorum; deep fascia.

Inner & under surfaces of internal cuneiform bone & base of first metatarsal. – S. by anterior tibial nerve.

Extensor Longus Digitorum – Outer tuberosity of tibia; upper three-fourths of anterior surface of shaft of fibula; interosseous membrane; septa between it and tibialis anticus & peronei muscles; deep fascia.

Bases of 2nd & 3rd phalanges of four outer toes. – S. by anterior tibial nerve.

Extensor Proprius Pollicis – Middle two-fourths of anterior surface of shaft of fibula internally to extensor longus digitorum; interosseous membrane.

Base of last phalanx of great toe. – S. by anterior tibial nerve.

Peroneus Tertius – Lower fourth of anterior surface of shaft of fibula; lower part of interosseous membrane; intermuscular septum between it & peroneus brevis.

Base of 5th metatarsal bone. – S. by anterior tibial nerve.

FIBULAR REGION.

Peroneus Longus – Head & upper two-thirds of outer surface & of anterior & posterior borders of fibula; intermuscular septa between it & muscles of front & back of leg; deep fascia.

Outer side of base of first metatarsal bone. – S. by musculo-cutaneous branch of external popliteal nerve.

Peroneus Brevis – Lower two-thirds of outer surface of shaft of fibula, passing upwards in a pointed process beneath peroneus longus; intermuscular septa between it & muscles of front & back of leg.

Base of fifth metatarsal bone. – S. by musculo-cutaneous branch of external popliteal nerve.

MUSCLES of LOWER LIMB—6th Tablet.

POSTERIOR TIBIO-FIBULAR REGION.

SUPERFICIAL LAYER.

Gastrocnemius.

Inner Head – Depression at upper and back part of inner condyle.

Outer Head – Depression at upper & back part of outer condyle above groove for popliteus. – Both heads also arise from lower part of the two inferior divisions of linea aspera.

By a strong aponeurosis which covers front of the muscle, and contracts into a tendon which joins with that of soleus, into lower part of posterior surface of os calcis. – S. by internal popliteal nerve.

Soleus – Back of head & upper third of posterior surface of shaft of fibula; middle third of inner border and oblique line on posterior surface of shaft of tibia; tendinous arch between tibial & fibular origins of the muscle beneath which arch pas posterior tibial vessels & nerve.

By a strong aponeurosis which covers posterior surface of the muscle and contracts into a tendon which joins with that of gastrocnemius (Tendo Achillis), into lower part of posterior surface of os calcis. – S. by internal popliteal nerve.

Plantaris – Lower part of outer division of linea aspera & post. ligament of knee-joint

Joins inner border of tendo Achillis. – S. by internal popliteal nerve.

DEEP LAYER.

Popliteus – Anterior & deepest part of groove on outer side of outer condyle of femu below tubercle for external lateral ligament of knee-joint.

Inner two-thirds of triangular surface on back of upper part of tibia abov oblique line. – S. by internal popliteal nerve.

Flexor Longus Pollicis – Lower two-thirds of posterior surface of shaft of fibula lower part of interosseous membrane; intermuscular septum between it & peronei; fascia over tibialis posticus.

Base of the last phalanx of great toe. – S. by posterior tibial nerve.

Flexor Longus Digitorum – Posterior surface of shaft of tibia below oblique line & internally to attachment of tibialis posticus; fascia over tibialis posticus.

Bases of last phalanges of four outer toes. – S. by posterior tibial nerve.

Tibialis Posticus – Posterior surface of shaft of tibia below oblique line & externall to attachment of flexor longus digitorum; nearly whole of posterior surface o interosseous membrane; upper three-fourths of inner surface of shaft of fibula fascia between it & foregoing muscles.

Tuberosity of scaphoid and internal & external cuneiform bones. – Supplie by posterior tibial nerve.

MUSCLES of the FOOT.

DORSAL REGION.

Extensor Brevis Digitorum – Outer & upper surfaces of greater process of os calcis, calcaneo-astragaloid ligament, anterior annular ligament of tarsus.

First phalanx of great toe & outer sides of long extensor tendons of 2nd, 3rd, & 4th toes. – S. by external branch of anterior tibial nerve.

PLANTAR REGION.

FIRST LAYER.

Flexor Brevis Digitorum – Greater tuberosity of os calcis; central part of plantar fascia; intermuscular septa on either side.

Sides of second phalanges of four outer toes. – S. by int. plantar n.

Abductor Pollicis – Greater tuberosity of os calcis; internal annular ligament; intermuscular septum between it and flexor brevis digitorum.

Inner side of base of first phalanx of great toe. – S. by int. plantar n.

Abductor Minimi Digiti – Lesser tuberosity of os calcis, greater tuberosity in front of flexor brevis, and slightly from under surface of os calcis in front of tuberosities; plantar fascia; intermuscular septum between it & flexor brevis.

Outer side of base of first phalanx of little toe. – S. by trunk of external plantar nerve before its bifurcation.

SECOND LAYER.

Flexor Longus Digitorum.

Flexor Accessorius – Inner & under surfaces of os calcis by two heads which embrace the long plantar ligament.

Outer border and upper & under surfaces of tendon of flexor longus digitorum. – S. by trunk of external plantar nerve before its bifurcation.

Lumbricales – Tendons of flexor longus digitorum, the innermost from one, the others from two tendons.

Inner side of extensor tendons & inner side of bases of first phalanges of four outer toes. – S., the two inner ones by internal plantar nerve, the two outer ones by deep branch of external plantar.

Flexor Longus Pollicis.

THIRD LAYER.

Flexor Brevis Pollicis – By a tendinous process from adjoining borders of cuboid & external cuneiform, & from expansion of tendon of tibialis posticus.

Inner & outer sides of base of first phalanx of great toe, a sesamoid bone being developed in each tendon of insertion. – S. by int. plantar n.

Flexor Brevis Minimi Digiti – Base of 5th metatarsal bone & sheath of peroneus longus.

Outer side of base of first phalanx of little toe. – S. by superficial branch of external plantar nerve.

Adductor Pollicis – Bases of 2nd, 3rd, & 4th metatarsal bones & sheath of peroneus longus.

Outer side of base of first phalanx of great toe. – S. by deep branch of external plantar nerve.

Transversus Pedis – Head of 5th metatarsal bone & transverse ligament of the metatarsus.

Outer side of base of first phalanx of great toe. – S. by deep branch of external plantar nerve.

FOURTH LAYER.

Plantar Interossei – Three. Arise from lower or plantar half of inner side of shaft of 3rd, 4th, & 5th metatarsal bones, and are inserted into inner side of base of first phalanx of corresponding toes, & into the expansion of the corresponding long extensor tendon. – They adduct the toes towards the second toe. – S. by external plantar nerve.

Dorsal Interossei – Four. Arise from the adjacent sides of two metatarsal bones, as follows: – from the whole extent of the side of the metatarsal bone which corresponds to the toe into which the muscle is inserted inferiorly, from the upper or dorsal half only of the side of the other. They are inserted into the corresponding side of the base of the first phalanx of the toe to which they belong. – They are found on both sides of the 2nd toe and on the outer side of the 3rd & 4th toes. – They abduct therefore the three middle toes from an imaginary line drawn through the second toe. – S. by external plantar nerve.

THE HEART AND ARTERIES.

THE PERICARDIUM.

Fibro-serous sac containing the heart & the commencement of the large vessels. –

The serous layer forms a common sheath to the aorta & pulmonary artery as far about two inches from their origin. It is then reflected upon the anterior aspect of t venæ cavæ & pulmonary veins, and upon the inner surface of the fibrous layer. Marshall's "vestigial fold of the pericardium" containing the remains of the left su erior cardinal vein of the embryo, may be seen in front of the root of the left lung.

The fibrous layer is prolonged upon the great vessels of the root of the neck, a becomes continous superiorly with the deep layer of the deep cervical fascia, that is say with the layer of fascia which encloses the omo-hyoid muscles, the carotid vesse & the trache

The pericardium is conical in shape, and presents : –

Anterior Aspect – Covered by loose areolar tissue & remains of thymus gland, lungs, pleur middle piece of sternum, and costal cartilages of the left side from the 3rd to the 7

Posterior Aspect – In contact with roots of the lungs, œsophagus & descending aorta.

Lateral Aspects – Covered by pleuræ, and crossed by phrenic nerve & superior phrenic vesse

Apex - Directed upwards upon great vessels.

Base – Attached to central or cordiform tendon, & to left anterior costal fibres of diaphragm.

HE HEART

Lies within the pericardium, between the two lungs, behind the lower two-thirds of the sternum, and projects about three inches into the left side, & one into the right side of the thorax. – It presents:

Base – Formed by the auricles, attached to the great vessels, directed upwards backwards & to the right; corresponds to the interval between the 5th & 8th dorsal vertebræ.

Apex – Formed by the point of the left ventricle, directed downwards, forwards & to the left; corresponds to the 5th intercostal space of the left side, two inches below and one to the inner side of the nipple.

Anterior Surface – Formed chiefly by right ventricle, the anterior interventricular groove lying near the left border; convex, looks upwards & forwards, and extends from level of upper borders of third costal cartilages to a line drawn from lower end of gladiolus to situation of apex.

Posterior Surface – Formed chiefly by left ventricle, the posterior interventricular groove lying near the right border; flattened; rests upon diaphragm.

Right Border – Long, thin, rests upon diaphragm; formed by right ventricle.

Left Border – Short thick, much less inclined than the right one; formed by left ventricle.

INTERIOR of the HEART—1st Tablet.

RIGHT SIDE.

Is larger in its auricular portion, and has thinner walls than the left.

- **AURICLE** — Divided into:
  - **Appendix Auriculæ** – Narrow indented pouch, which overlaps the arch of t aorta, and presents on its inner surface the *musculi pectinati*, whi extend somewhat into the sin
  - **Sinus** – The central cavity; presents: –
    - Opening of the Superior Vena Cava – Somewhat smaller than that of inferior cava; situated at the upper & front part; looks do wards & forwards, and has near it
      - *Tubercle of Lower* – Small eminence, scarcely visible in man, situated right wall of auricle between the two venæ ca
    - Opening of the Inferior Vena Cava – Somewhat larger than that of superior cava; situated at the lower & back part near the septu looks upwards & inwards, and presents
      - *Eustachian Valve* – Semilunar in form with concave free, and convex tached margins; situated below the opening of the inferior ve cava between it & the auriculo-ventricular opening, and passes wards & to the left to the anterior margin of the annulus ova Small in the adult. Contains a few muscular fib
    - Opening of the Coronary Sinus – Situated below the opening of the infer vena cava & the Eustachian valve. Presents
      - *Coronary Valve or Valve of Thebesius.*
    - Foramina Thebesii – Some of which are the openings of the venæ cor minimæ, while others are but small blind depressio
    - Auriculo-Ventricular Opening – With the tricuspid valve (Vide below).
    - Foramen Ovale – In the fœtus. Situated at the lower & back part of sept above opening of inferior vena cava; replaced in adult by
      - *Fossa Ovalis* – Oval depression surrounded by a prominent circular rim,
      - *Annulus Ovalis,* – and which often presents a small valvular opening its upper p
- **VENTRICLE** — Triangular in shape, and has much thinner walls than the left c Prolonged upwards & to the left into the *Infundibulum or Co arteriosus*. Present
  - Auriculo-Ventricular Opening – Oval, broadest from side to side. Situa behind the centre of the sternum on a level with the 3rd costal c tilages, on the right side of the aortic & left auriculo-ventric openings. Guarded by
    - *Tricuspid Valve* – Presents three triangular segments, which are attac superiorly to the margin of the auriculo-ventricular ring & later to each other, and of which the left one is the largest. They formed by a central fibrous lamina attached superiorly to the rous ring of the opening and covered by a duplicature of the en cardium. Their under surface & borders give attachment to *chordæ tendi*
  - Opening of the Pulmonary Artery – Situated at the apex of the conus a riosus opposite the upper border of the third costal cartilage of left side close to the sternum. Guarded by
    - *Semilunar Valves* – Three; formed of fibrous tissue surrounded by a plicature of the endocardium, and prese
      - *Convex margin* – Attached to the fibrous ring of the orifice;
      - *Free margin* – Slightly concave, strengthened by a bundle of tendin fibres, presenting in the centre a fibro-cartilaginous nodule, *corpus Arantii*, and laterally two thin lunated portions, *lunulæ*. Above the valves are three small pouches,
    - *Sinuses of Valsalva.*
  - Columnæ Carneæ – Three sorts, which are attached respectively by one s by both extremities, by one extremity only, to the wall of the v tricle. The latter are
    - *Musculi Papillares* – Three or four; give origin to the *Chordæ Tendineæ*

NTERIOR of the HEART—2nd Tablet.

LEFT SIDE.

Has thicker walls than the right, and is smaller in its auricular portion.

AURICLE — Divided, as is the right, into two parts, the

Appendix Auriculæ - Longer, narrower, more curved & indented than on right side, and constricted at its orifice; its musculi pectinati are smaller & less numerous. Overlaps pulmonary artery.

Sinus - More regularly cuboid than on right side. - Presents:

Openings of the Pulmonary veins - Four, at upper part, two on the right close to septum, two on the left, the latter sometimes uniting.

Auriculo-Ventricular Opening - With the Mitral valve (Vide below).

VENTRICLE — Rounded & conical; its walls are thicker than those of the right. Presents:

Auriculo-Ventricular Opening - Situated opposite centre of sternum on a level with third costal cartilages, between & behind the aortic & right auriculo-ventricular openings, or rather directly behind the aortic opening (Sibson). Somewhat smaller than on right side. Presents the

Mitral Valve - Larger, thicker & stronger than the tricuspid. Consists of two principal segments, of which the largest is in front. The chordæ tendineæ attached to its under surface are stronger & thicker, but are less numerous, than those on the right side.

Aortic Opening - Situated behind centre of sternum on a level with lower border of 3rd costal cartilage, and directly in front of the left auriculo-ventricular opening. Presents the

Semilunar Valves - Larger, thicker & stronger than those of pulmonary artery; lunulæ wider, corpora Arantii more prominent, and sinuses of Valsalva deeper.

Columnæ Carneæ - Those attached by one side and those attached by both extremities are smaller & more numerous. The musculi papillares are but two in number, but are larger, and are attached, one to the anterior, the other to the posterior wall of the ventricle.

STRUCTURE of the HEART—1st Tablet.

Presents for examination the fibrous rings of the arterial & auriculo-ventricular openings and the muscular fibres

FIBROUS RINGS — The aortic & the two auriculo-ventricular rings lie close together behind the centre of the sternum on a level with the 3rd costal cartilages, and are bound together by a fibro-cartilaginous mass which becomes ossified in some of the large animals. – The aortic ring lies in front of the left auriculo-ventricular; the righ auriculo-ventricular ring lies between, & to the right of, the two others. – The fibrou ring of the pulmonary artery is situated at the apex of the infundibulum opposite th upper border of the 3rd costal cartilage of the left side close to the sternum.

These rings give attachment to the mitral, tricuspid & semilunar valves, to th muscular fibres of the auricles, and to some of the most superficial fibres of the ventricles. The margin of the arterial rings which is turned towards the auricles, i scalloped into three semilunar notches filled up by corresponding projections of th middle coat of the artery, the attachment of the arteries to the rings being strengthened externally by the pericardium and internally by the endocardium

MUSCULAR FIBRES — Are striated, but are about ½ smaller than those of striated muscles generally, and their striation is not so distinct. They divide and anastomos with each other, and they often contain fat cells. Their perimysium is but scanty

Fibres of the Auricles – Are mostly transverse, superficial, & common to bot auricles; some however lie deeper, and are proper to each auricle

Superficial, Transverse, or Common Fibres – Surround mainly the base of th sinuses, and are most marked anteriorly. Some dip into the interauricular septum

Deep or Proper Fibres – May be divided into:

Looped Fibres – Arch over each auricle from before backwards, and are a tached to the auriculo-ventricular rings both in front & behind

Annular Fibres – Encircle the appendices auriculæ, and the venæ cavæ, pu monary & coronary veins, extending for some distance upon the veins

Fibres of the Ventricles – Vide next Tablet.

STRUCTURE of the HEART—2nd Tablet.

FIBRES OF THE VENTRICLES

Form seven layers differing from each other by the direction of their fibres.

These layers are continuous with each other at the apex & at the base of the heart as follows: – the 1st, or most external layer, with the 7th, or most internal layer.
„ 2nd, „ 6th,
„ 3rd, „ 5th,
The fibres of the 4th or central layer return upon those of the same set.

Together, the 1st & 7th layers form a kind of double ring inclosing all the other layers; the 2nd and 6th layers, a kind of double ring inclosing the 3rd, 4th, and 5th layers; the 3rd and 5th layers, a kind of double ring inclosing the 4th layer. As a consequence the double ring formed by the 1st and 7th layers extends farther towards the apex & the base of the heart than the double ring formed by the 2nd & 6th layers, which latter double ring extends farther than the double ring formed by the 3rd & 5th layers; and the 4th or central layer is the least extensive of all. This explains the greater thickness of the walls of the ventricles towards the middle of their length than at either extremity. – The outer layers, it may be added, are thinner than the inner ones.

The fibres of the three outer layers are inclined downwards & to the left on the anterior aspect of the heart, downwards & to the right on the posterior aspect; and they become less vertical in each successive layer. The fibres of the 4th layer are horizontal or transverse. The fibres of the three inner layers are inclined upwards & to the left on the anterior aspect of the heart, upwards & to the right on the posterior aspect, crossing the fibres of the three outer layers, and becoming more & more vertical or longitudinal in the successive strata.

Some of the superficial fibres, especially those of the posterior surface, pass round and enclose both ventricles; the mass of the fibres, however, enclose but one ventricle.

In the three outer layers the anterior fibres proper to the left ventricle issue from the inner & front part of the corresponding arterial & auriculo-ventricular openings & from the front of the interventricular septum; these anterior fibres pass downwards & to the left, with a few of the anterior common superficial fibres, and get to the back part of the apex. The posterior fibres proper to the left ventricle issue from the outer & back part of the corresponding arterial & auriculo-ventricular openings & from the back of the interventricular septum; these posterior fibres pass downwards & to the right, with a somewhat considerable number of the posterior common superficial fibres, and get to the front of the apex. Here all the fibres, both anterior & posterior, curl inwards in a whirl-like manner, the anterior fibres going to form the three inner strata on the posterior wall of the ventricle, and the posterior fibres going to form the three inner strata on the anterior wall.

In the right ventricle the fibres of the three outer layers issue partly from the corresponding arterial & auriculo-ventricular openings, and are partly continuous with the posterior common superficial fibres. Descending spirally from left to right on the posterior aspect of the heart, and from right to left on the anterior aspect, they reach the anterior interventricular groove. Here a few fibres are continued on to the left ventricle, forming the anterior common superficial fibres; the greater number pass backwards, however, in the interventricular septum, at the back of which they decussate with the fibres of the left ventricle, and blend with the posterior common supersuperficial fibres.

It must be added that none of the fibres, except a few of the most superficial ones, can now be said to *arise* from the arterial & auriculo-ventricular rings. The strata are merely continued opposite these rings, the superficial ones into the deep ones, and *vice versa.*

CORONARY or CARDIAC VESSELS.

CORONARY OR CARDIAC ARTERIES

— Two. From upper part of the bulgings corresponding to the two anterior sinuses of Valsalva just above free margin of semilunar valves.

Left or Anterior – The smaller. Forwards & to the left between pulmonary artery & left auricular appendix, and divides into branches:

- Horizontal – The smaller; along left auriculo-ventricular groove, and joins with horizontal branch of right or posterior coronary.
- Descending – The larger; along anterior interventricular groove to apex of heart, where it joins with descending branch of right or posterior coronary.

Right or Posterior – The larger. Forwards & to the right between pulmonary artery & right auricular appendix, and then backwards along right auriculo-ventricular groove, sending a large branch down right border of heart, and divides into branches:

- Horizontal – The smaller; along left auriculo-ventricular groove, and joins with horizontal branch of left or anterior coronary.
- Descending – The larger; along posterior interventricular groove to apex of heart, where it joins with descending branch of left or anterior coronary.

CORONARY OR CARDIAC VEINS.

Great Cardiac Vein – Ascends from apex of heart along anterior interventricular groove, turns backwards along left auriculo-ventricular groove, receiving an ascending branch of some size from left border of heart, and opens into left extremity of the coronary sinus, its opening being guarded by two valves.

Posterior Cardiac Vein – Ascends from apex of heart, where it communicates with preceding, along posterior interventricular groove, and opens into right extremity of coronary sinus, its opening being guarded by a valve. It receives the veins from the posterior surface of both ventricles.

Coronary Sinus – Thick trunk about an inch long situated at back part of left auriculo-ventricular groove, and partly covered & concealed by muscular fibres of left auricle. It receives the great & posterior cardiac veins, and a small vein, the remnant of the left superior cardinal vein of the embryo (Marshall), which passes downwards & to the right along back part of left auricle. It opens into the lower & back part of the right auricle close to the septum, below the opening of the inferior vena cava & Eustachian valve. Its opening is guarded by the valve of Thebesius.

Small or Anterior Cardiac Veins & Venæ Cordis Minimæ – Several small branches, which collect the blood from the anterior surface of the right ventricle, and from the muscular substance of the heart, and which open separately into the lower part of the right auricle (foramina Thebesii); one larger than the others, runs along the right border of the heart.

ULMONARY VESSELS.

PULMONARY ARTERY.

Short thick trunk about two inches long, which conveys the venous blood from the right side of the heart to the lungs.

Arises from apex of infundibulum of right ventricle opposite upper border of 3rd costal cartilage of left side close to sternum.

Upwards, backwards & to the left, winding spirally in front & then to the left of ascending portion of arch of aorta, the two vessels being contained in one tubular sheath of the serous layer of the pericardium. – On either side of the artery are the auricular appendices & the coronary arteries; behind it are the aorta & the left auricle.

Pierces fibrous layer of pericardium, and divides below & in front of transverse portion of arch of aorta into: –

Right Pulmonary Artery – The larger & longer. To the right behind ascending aorta & superior vena cava to root of right lung, in which it lies, both from before backwards and from above downwards, between the pulmonary veins & the bronchus. Divides into:

- SUPERIOR BRANCH – The smaller, to superior & middle lobes.
- INFERIOR BRANCH – The larger, to inferior lobe.

Left Pulmonary Artery – The smaller & shorter, connected at its root by remains of ductus arteriosus to under surface of arch of aorta. To the left in front of descending aorta, lying, in root of left lung, above the veins & the bronchus, but behind the former & in front of the latter. Divides into:

- SUPERIOR BRANCH – The smaller, to superior lobe.
- INFERIOR BRANCH – The larger, to inferior lobe.

PULMONARY VEINS.

Usually four. Commence upon the intercellular passages & air-cells in the capillary network of the pulmonary artery, but are also continuous with some of the terminal ramifications of the bronchial arteries.

Their smaller divisions are but very little larger than the corresponding branches of the pulmonary artery, and they accompany these singly, and form a single trunk for each lobule.

Their larger branches are destitute of valves, and form a single trunk for each lobe, the trunk from the middle lobe of the right lung uniting with that from the upper.

The two trunks from right lung pass behind superior vena cava, right auricle & ascending aorta, and those from left lung cross anteriorly the descending aorta; all are invested anteriorly by serous layer of pericardium.

In the lung the pulmonary vessels are generally found to lie in front of the corresponding bronchial tubes, the artery being above the vein. In the roots of the lungs the pulmonary veins lie in front of the arteries, and the arteries in front of the bronchus; and the order from below upwards is *veins, artery, bronchus,* on the right side, *veins, bronchus, artery,* on the left. There is sometimes a small distinct vein for middle lobe of right lung. The two left pulmonary veins often unite into one trunk.

THE ARCH of the AORTA.

From upper part of left ventricle to left side of lower border of body of 4th dorsal vertebra (some authors say 3rd, some say 5th), describing a curve, the convexity of which is directed upwards & to the right. Is divided into:-

ASCENDING PORTION — About two inches long. Upwards, forwards, & to the right from opposite centre of sternum on a level with lower border of 3rd costal cartilages to upper border of 2nd costal cartilage of right side close to sternum. Contained in pericardium together with trunk of pulmonary artery. – RELATIONS:

In Front – Pulmonary artery, right auricular appendix, pericardium, loose areolar tissue, remains of thymus gland, sternum.
Behind – Right pulmonary vessels, & root of right lung.
To the Right – Superior vena cava, right auricle.
To the Left – Trunk of pulmonary artery.

TRANSVERSE PORTION — Backwards & to the left from upper border of 2nd costal cartilage of right side close to sternum to left side of body of 3rd dorsal vertebra (some authors say 2nd, some say 4th). – RELATIONS:

In Front – Left pneumogastric & phrenic nerves, cardiac branches of sympathetic, left lung & pleura.
Behind – Trachea, œsophagus, thoracic duct, left recurrent laryngeal nerve, great or deep cardiac plexus
Above – Left innominate vein, innominate, left common carotid, & left subclavian arteries
Below – Left bronchus, right pulmonary artery, left recurrent laryngeal nerve remains of ductus arteriosus

DESCENDING PORTION — Along left side of 3rd & 4th to lower border of 4th dorsal vertebra (some authors say along left side of 2nd & 3rd to lower border of 3rd, some say along left side of 4th & 5th to lower border of 5th), where it becomes thoracic aorta. – RELATIONS

In Front – Pleura, root of left lung.
Behind – Body of 4th dorsal vertebra (some authors say of 3rd, some say of 5th)
To the Right – Œsophagus, thoracic duct.
To the Left – Left lung & pleura.

The aorta is somewhat dilated just above its origin, where it presents externally three small bulgings corresponding to the sinuses of Valsalva; two of these bulgings are anterior, and one is posterior; an from the two anterior ones the coronary arteries are seen to arise. Th most prominent part of the arch lies about ¼ of an inch behind the posterior surface of the sternum. The height to which the arch usuall rises in the chest is about 1 inch below the upper border of the sternum

BRANCHES — Left or Anterior, & Right or Posterior Coronary,
Innominate, Left Common Carotid, Left Subclavian.

HE THORACIC AORTA.

Commences at left side of lower border of 4th dorsal vertebra (some Authors say 3rd, some say 5th). Descends through posterior mediastinum, curving slightly forwards and inclining slightly to the right, and ends at aortic opening of diaphragm in front of 12th dorsal vertebra. – RELATIONS:

In Front – Root of left lung, pericardium, œsophagus.
Behind – Vertebræ, vena azygos minor.
To the Right – Œsophagus (above), vena azygos major, thoracic duct.
To the Left – Left lung & pleura, œsophagus (below).

BRANCHES:

Pericardiac – Small, irregular; forwards to pericardium.

Bronchial – The nutrient vessels of the lungs. On left side, generally two arising from thoracic aorta one above the other; on right side, but one usually arising either from first aortic intercostal, or from front of aorta in common with artery of left side. Along back of corresponding bronchus, dividing & subdividing upon bronchial tubes, and supplying bronchial glands & cellular tissue of lung; give a few twigs to œsophagus.

Œsophageal – Usually four or five from front of aorta. Descend obliquely upon œsophagus anastomosing with each other, and with the œsophageal branches of the inferior thyroid, inferior phrenic & gastric.

Posterior Mediastinal – Small irregular branches to glands and cellular tissue of mediastinum.

Aortic Intercostals – From back of aorta. Usually ten in number, sometimes only nine, the second intercostal space being sometimes supplied, as well as the first, by the superior intercostal branch of the subclavian. To corresponding intercostal space, passing on

Left Side – Beneath smaller azygos & left superior intercostal veins, and left cord of sympathetic;
Right Side – Round bodies of vertebræ beneath œsophagus, thoracic duct, greater azygos, & right cord of sympathetic, – and divide into anterior & posterior branches.

Anterior Branch, or Intercostal Proper – Upon external intercostal muscle and beneath pleura & a thin layer of fascia, to lower border of rib above, and divides between the two intercostal muscles into branches:

Superior – The larger; along groove on inner surface of rib above;
Inferior – The smaller; along upper border of rib below, – which branches supply intercostal muscles, and anastomose with thoracic branches of axillary & anterior intercostal branches of internal mammary.

The three last intercostals are prolonged between abdominal muscles, and anastomose with epigastric, inferior phrenic & lumbar; the first one anastomoses with superior intercostal. – In the intercostal spaces the vein usually lies above the trunk of the artery & its superior branch, and the nerve below.

Posterior or Dorsal Branch – Backwards on inner side of superior or long costo-transverse ligament with posterior branch of corresponding spinal nerve, and divides into branches:

Spinal – Through intervertebral foramen to cord & its membranes and posterior aspect of bodies of vertebræ.
Muscular – Divides into *internal offset* to multifidus spinæ & integument near spine, and *external offset*, which passes between sacro-lumbalis & longissimus dorsi to superficial muscles & integument.

THE SUBCLAVIAN ARTERY.

From innominate artery behind upper border of sterno-clavicular articulation (right side) from end of transverse portion of arch of Aorta (left side), to outer border of first ri
Divided into three parts:

FIRST PART — From origin to inner border of scalenus anticus. Differs on the two sides.

RIGHT SIDE — Arches upwards & outwards across root of neck, and is shorter & mor superficial than on left side. – Relations

In Front – Sterno-clavicular articulation, sterno-mastoid, -hyoid, & -thyroid, dee layer of fascia; – and the artery is crossed by Internal & anterior jugular and vertebral veins, pneumogastric phrenic nerves, and cardiac branches of sympatheti

Behind – Longus colli, transverse process of 7th cervical vertebra, cord of sym pathetic, recurrent laryngeal nerv

Below – Pleura.

Subclavian Vein lies below & in front of artery immediately behind claviol

LEFT SIDE — Ascends nearly vertically, and is longer & more deeply situated. – Relation

In Front – Same, plus left lung & pleura, left innominate v., left com. carotid; – an Pneumogastric & phrenic nerves & cardiac branches of sympath tic are nearly parallel to the arter

Behind – Same, plus œsophagus & thoracic duct.

On Inner S.–Trachea, æsophagus, thoracic duct, left common carotid artery.

On Outer S.–Pleura.

BRANCHES — **Vertebral, Internal Mammary, Thyroid Axis** – Ari close together near inner border of scalenus anticus, interval measuring usually from ½ an inch to 1 inch being le between the origin of the artery & its first branch. On t left side the **Superior Intercostal** also usually aris from this part of the arte

SECOND PART — Lies behind scalenus anticus at a somewhat variable level above cla icle. Short; forms higest part of arch described by the artery. – Relation

In Front – Scalenus anticus, subclavian vein, phrenic nerve.

Behind – Scalenus medius.

Above – Brachial plexus.

Below – Pleura.

Subclavian Vein lies below & in front of artery, from which it is separated scalenus antic

BRANCHES — **Superior Intercostal** on right side; generally no branch left si

THIRD PART — From outer border of scalenus anticus to outer border of first rib. Cross lower & inner part of posterior triangle of neck, lying in the small spa bounded by omo-hyoid, clavicle & scalenus ant. – Relation

In front – Skin, superficial fascia, platysma, descending branches of superfici cervical plexus, deep fascia, transversalis colli vei Clavicle, subclavius & its nerve, transversalis humeri vessels, exte nal jugular vein with the plexus frequently formed by t suprascapular & transversalis col

Behind – Scalenus medius.

Above – Brachial plexus, omo-hyoid.

Below – Outer surface of first rib.

Subclavian vein lies below, in front, & to inner side of artery.

BRANCH — Frequently the **Posterior Scapular,** which is otherwise deriv from the transversalis co

RANCHES of the SUBCLAVIAN ARTERY—1st T.

Vertebral – Vide "Arteries of the head & Neck."

Internal Mammary – From under surface of subclavian, opposite thyroid axis.

Downwards behind phrenic nerve and internal jugular & subclavian veins to posterior aspect of costal cartilages a short distance from sternum.

Descends between thoracic wall & pleura, giving off branches: –

Perforating, Anterior Intercostal, Anterior Mediastinal, & Comes Nervi Phrenici, and divides between 6th & 7th costal cartilages & beneath triangularis sterni into branches

Musculo-phrenic, & Superior Epigastric.

Its two venæ comites unite into one trunk before they open into the innominate.

PERFORATING – Five or six. Forwards through intercostal spaces, and then outwards to pectoralis major, integument, & mamma.

ANT. INTERCOSTAL – Five or six. Outwards in five or six upper intercostal spaces between internal intercostal muscles & pleura, and divide between internal & external intercostal muscles into superior & inferior branches which inosculate with corresponding branches of corresponding aortic intercostals, and are similarly distributed.

ANTERIOR MEDIASTINAL – Small, irregular; to pericardium, remains of thymus gland & cellular tissue of anterior mediastinum.

COMES NERVI PHRENICI (SUPERIOR PHRENIC) – From upper part of artery. Long, slender; with phrenic nerve to diaphragm, and anastomose with musculo-phrenic, & inferior phrenic from abdominal aorta.

MUSCULO-PHRENIC – Downwards & outwards behind cartilages of false ribs, supplying diaphragm, which it perforates opposite 8th or 9th rib, & abdominal muscles, and giving off a small anterior intercostal branch to each of the lower intercostal spaces.

SUPERIOR EPIGASTRIC – Enters sheath of rectus posteriorly, and anastomoses with epigastric branch of external iliac, lower intercostals & lumbar; gives twigs to rectus & to integument of middle line of abdomen.

Thyroid Axis – Vide next Tablet.

Superior Intercostal – From upper & back part of 1st portion of subclavian on left side, of 2nd portion on right side. Passes backwards for a short distance, and gives off its deep cervical branch; it then descends in front of neck of 1st rib, or in front of necks of 1st & 2nd ribs on outer side of 1st dorsal ganglion of sympathetic, gives off one or two branches similar to the aortic intercostals, and joins with the first of the latter arteries.

DEEP CERVICAL OR PROFUNDA CERVICIS – Sometimes arises directly from subclavian. Backwards between neck of 1st rib & transverse process of 7th cervical vertebra, and ascends between complexus & semispinalis colli, anastomosing with vertebral artery & deep branch of arteria princeps cervicis.

BRANCHES of the SUBCLAVIAN ARTERY—2nd T.

THYROID AXIS — Short thick trunk from front of first part of subclavian close to inn border of scalenus anticus. Divides almost immediately into

Inferior Thyroid

– Tortuous course upwards & inwards behind common carotid arte & sympathetic nerve, (the middle cervical ganglion, when present, resting up it) to under surface of thyroid gland, and anastomoses with the other thyrc arteries. – Gives off branche

Ascending Cervical – Ascends between scalenus anticus & rectus capitis antic major; gives branches to deep muscles of neck, and, through the int vertebral foramina, to spinal cord & its membranes and bodies of t vertebı

Laryngeal – Upon trachea to back of larynx; supplies muscles & mucous me bra

Tracheal – Join below with bronchial.

Œsophageal – Descend upon œsophagus.

Suprascapular or Transversalis Humeri

Crosses lower part of scalenus anticus under cover of sterno-mastoid.

Outwards behind clavicle, beneath omo-hyoid.

Beneath trapezius, and over transverse ligament of scapula to supraspinous fos where it ramifies between the muscle & the bo

Crosses neck of scapula to infraspinous fossa. – Anastomoses with the ot scapular arteries, supplies shoulder-joint & subscapularis, and gives off small supra-acromial tw

Transversalis Colli

Crosses upper part of subclavian triangle in front of scaleni & brachial plex passing sometimes between the trunks of the plexus, and divides bene trapezius in

Superficial Cervical – Ascends beneath trapezius to muscles & glands of back neck, and anastomoses with superficial branch of arteria prince cervi

Posterior Scapular – Beneath levator anguli scapulæ to superior angle of scap and then along posterior border of the bone beneath rhomboidei as as its inferior angle, anastomosing with the other scapular arteries the intercostals. Frequently arises from 3rd part of subclavı

THE MEDIASTINUM

Is the antero-posterior septum comprised between the two lungs & pleuræ. It is divided into three parts by the pericardium, heart, & large vessels.

Anterior Mediastinum – Is the part in front of the pericardium, heart, & large vessels. It is narrow above, where it contains the remains of the thymus gland, the origins of the sterno-hyoid & -thyroid, the upper part of the left internal mammary vessels, a large quantity of loose areolar tissue, & a few lymphatic glands. It is narrower still behind the middle piece of the sternum, where the two pleuræ come in direct contact as low down as the 4th costal cartilage. Quite inferiorly, in consequence of the notch in the lower part of the anterior border of the left lung, it expands to the left behind the 4th & 5th intercostal spaces of the left side; here it contains the lower part of the left internal mammary vessels, & that part of the triangularis sterni muscle, which overlies the apex of the heart.

Middle Mediastinum – Is the part which contains the pericardium, heart & large vessels (ascending aorta, pulmonary vessels, superior vena cava; – the inferior vena cava enters pericardium through opening in cordiform tendon of diaphragm), and also the phrenic nerves. It is the widest part of the mediastinum.

Posterior Mediastinum – Is the part behind the pericardium, heart, & large vessels. It contains the descending aorta, trachea, œsophagus; the venæ azygos major & minor & the left superior intercostal; the pneumogastric & splanchnic nerves; the thoracic duct; fat & lymphatic glands.

INNOMINATE ARTERY

Arises from commencement of arch of Aorta in front of left common carotid.
Upwards & to the right to upper border of right sterno-clavicular articulation, where divide
into right common carotid & right subclavian
Gives off occasionally the thyroidea ima. Its length is usually from an inch to an inch &
half.—RELATIONS

In Front — Sternum, sterno-hyoid & -thyroid, remains of thymus gland;
Left innominate & right inferior thyroid veins;
Inf. cervical cardiac br. of right pneumogastric.
Behind — Trachea.
On Inner Side — Left common carotid, remains of thymus gland.
On Outer Side — Right pneumogastric n., right innominate vein, pleura.

Thyroidea Ima — Is very variable in size, when present. Usually arises from innominate, sometimes from right common carotid or from Aorta. Ascends i
front of trachea to thyroid gland

COMMON CAROTID ARTERY.

Right common carotid arises from innominate artery behind steno-clavicular articulation.
Left common carotid arises from highest part of arch of Aorta, is longer, and has a thoracic portion deeply situated within the thorax.

THORACIC PORTION OF THE LEFT COMMON CAROTID ART.

Upwards & outwards to root of neck. — RELATIONS:

In Front — Sternum, sterno-hyoid & -thyroid, left innominate v., remains of thymus gland.
Behind — Trachea, œsophagus, thoracic duct.
On Inner Side — Innominate artery.
On Outer Side — Left pneumogastric & phrenic ns. & left subclavian art., left lung & pleura.

CERVICAL PORTION OF THE COMMON CAROTID ARTERIES.

Upwards & outwards from behind sterno-clavicular articulation to upper border of thyroid cartilage, where divides into external & internal carotid arts. Direction from sternal end of clavicle to midway between angle of jaw & mastoid pr. In same sheath of deep cervical fascia as int. jugular v. & pneumogastric n. Deeply situated at origin; superficial at termination. — RELATIONS:

In Front, *Lower part* — Skin, superf. f., platysma, ant. jugular v., deep f.; Sterno-mastoid, -hyoid, -thyroid, omo-hyoid, middle thyr. v.
Upper part — Skin, superf. f. platysma, deep f., inner border of sterno-mastoid.
Sterno-mastoid art., facial, lingual & sup. thyroid veins, descendens noni n.
Behind — Cervical vertebræ, longus colli, rectus capitis anticus major, inf. thyroid artery, sympathetic & recurrent laryngeal ns.
On Inner Side — Trachea, thyroid gland, larynx, pharynx; inferior thyroid art., recurrent laryngeal n.
On Outer Side — Internal jugular vein, pneumogastric n. — At lower part of neck int. jugular v. diverges from artery on right side, approaches and crosses it on left side.

EXTERNAL CAROTID ARTERY

From upper border of thyroid cartilage to interval between neck of condyle & external auditory meatus, where divides into temporal & internal maxillary.
At its origin it is more superficial & nearer middle line than int. carotid. — RELATIONS:

Covered by — Skin, superficial f., platysma, deep f., ant. border of sterno-mastoid; Lingual & facial veins, hypoglossal n., digastric & stylo-hyoid ms. Parotid gl., facial n., junction of temporal & internal maxillary vs.
On Inner Side — Wall of pharynx, portion of parotid gland, sup. laryngeal n.
Behind — Sup. laryngeal n., stylo-glossus & -pharyngeus, glosso-pharyngeal n., internal carotid art.

BRANCHES: Superior Thyroid, Lingual, Facial;
Occipital, Post. Auricular; — Ascending Pharyngeal;
Temporal, Int. Maxillary.

ANTERIOR BRANCHES of the EXTERNAL CAROTID.

SUP. THYROID — Arises from front of external carotid close to its origin beneath thin anterior margin of sterno-mastoid, and is quite superficial when this muscle is dissected from its sheath, for the latter then retracts and exposes the carotid vessels & their branches.

Tortuous course upwards & forwards, and then downwards & forwards beneath omo- & sterno-hyoid & -thyroid to anterior surface of thyroid body. Gives off brs:

Hyoid – Small; along lower border of hyoid bone beneath thyro-hyoid, and joins with its fellow.

Sterno-Mastoid or Superficial Descending – Descends to middle of sterno-mastoid, crossing carotid vessels.

Sup. Laryngeal – With superior laryngeal nerve to interior of larynx through outer part of thyro-hyoid membrane.

Crico-Thyroid – Small; crosses crico-thyroid membrane and joins with its fellow.

LINGUAL — Arises a little below hyoid bone beneath thin anterior margin of sterno-mastoid.

Upwards & forwards upon middle constrictor to great cornu of hyoid bone.
Horizontally forwards above great cornu beneath hyo-glossus, digastric & stylo-hyoid.
Upwards on genio-hyo-glossus.
Forwards with gustatory nerve on under surface of lingualis inferior, and then beneath mucous membrane to tip of tongue under name of ranine. – Gives off brs:

Hyoid – Small; along upper border of hyoid bone and joins with its fellow.

Dorsalis Linguæ – Ascends on genio-hyo-glossus to dorsum of tongue, epiglottis, soft palate & tonsil.

Sublingual – Forwards between mylo-hyoid & mucous membrane to sublingual gland.

Ranine – The terminal branch; joins with its fellow at tip of tongue.

FACIAL — Arises above preceding beneath thin anterior margin of sterno-mastoid.

Forwards & upwards beneath posterior belly of digastric & stylo-hyoid & submaxillary gld
Crosses jaw bone in front of masseter.
Forwards and upwards to angle of mouth upon buccinator & beneath platysma.
Upwards beneath zygomatici and upon levator anguli oris and the levators of the lip & ala of the nose to inner canthus, where becomes angular artery and join with ophthalmic
Is very tortuous in its course. Facial vein lies behind it, and is less tortuous. Gives of branches

Inferior or Ascending Palatine – Dips beneath ramus of jaw. Ascend between stylo-glossus & -pharyngeus and then upon superior constrictor in front of ascending pharyngeal, and supplies tonsil & soft palate

Tonsillar – Ascends upon and perforates sup. constrictor to tonsil & root of tongue

Submaxillary – Three or four, to submaxillary gland & surrounding muscles.

Submental – Forwards on under surface of mylo-hyoid, and between it an digastric to symphysis, where ascends upon chin

Inf. Labial – Forwards beneath depressor anguli oris, below following artery t tissues of lower lip

Inf. Coronary – Forwards beneath depressor anguli oris, and tortuous cours through substance of orbicularis and between it & mucous membran anastomosing with its fellow

Sup. Coronary – Larger and more tortuous; similar course along free edge o upper lip, giving twigs to ala and artery of septum to septum of nose

Lateralis Nasi – To ala and dorsum of nose.

Angular – To inner canthus, supplying lachrymal sac and anastomosing wit nasal branch of ophthalmic

All these branches anastomose freely with each other, with those of the opposite side, and with the mental, transverse facial, infra-orbital, ophthalmic, sublingual, posterior superior or descending palatine and ascending pharyngeal arteries

POSTERIOR BRANCHES of the EXTERNAL CAROTID.

OCCIPITAL — Arises just below posterior belly of digastric, and is crossed close to its origin by hypoglossal nerve.

Upwards and backwards beneath posterior belly of digastric, stylo-hyoid, & portion of parotid gland, crossing internal carotid artery, internal jugular vein, glosso-pharyngeal, pneumogastric & spinal accessory nerves, – and then between mastoid process & transverse process of atlas.

Horizontally backwards in occipital groove beneath sterno-mastoid, digastric, splenius & trachelo-mastoid, – and then between trapezius & complexus.

Pierces upper part of trapezius, ascends beneath integument with great occipital nerve, and divides into numerous branches to upper & back part of head. Gives off branches:

Muscular – Numerous small ones, and one large one to upper part of sterno-mastoid.

Auricular – To back of ear.

Meningeal – Through jugular foramen to dura mater of posterior fossa.

Arteria Princeps Cervicis – Descends beneath splenius, and divides into:

Superficial Br. – Descends between splenius & complexus, and anastomoses with superficial cervical branch of posterior scapular.

Deep Br. – Descends beneath complexus, and anastomoses with vertebral & with deep cervical branch of superior intercostal.

POST. AURICULAR — Arises beneath or above digastric & stylo-hyoid, and ascends under cover of parotid gland & beneath facial nerve to groove between cartilage of ear and mastoid process, where divides into

Ant. & Post. Branches – Which communicate respectively with posterior branch of temporal & with occipital, and of which the former gives off numerous branches to back of ear. – Gives off

Stylo-mastoid Art. (Sometimes derived from occipital). – Through stylo-mastoid foramen to tympanum & semicircular canals, joining with tympanic branch of internal maxillary, with which it forms in young subjects a vascular circle round membrana tympani.

NTERNAL BRANCH of the EXTERNAL CAROTID.

ASCENDING PHARYNGEAL — Long, slender; from back of external carotid near its origin.

Ascends vertically to base of skull, in front of internal carotid artery and between that vessel & side of pharynx, giving off branches:

External – Small, irregular, to 8th, 9th, and sympathetic nerves, and adjoining muscles.

Pharyngeal – Three or four; to the three constrictors, stylo-pharyngeus, Eustachian tube, soft palate & tonsil.

Meningeal – To dura mater through foramina lacera posterius & medium, and sometimes through anterior condyloid foramen.

TERMINAL BRANCHES of the EXTERNAL CAROTID.

TEMPORAL — The smaller.

Commences in substance of parotid gland between neck of condyle & external auditory meatus.

Ascends in groove between condyle & external auditory meatus, and crosses posterior root of zygoma.

Ascends for about two inches upon temporal muscle & fascia, and beneath skin & attrahens aurem, with branches of facial & auriculo-temporal nerves, and divides into:

- **Ant. Temporal** – The smaller. Forwards over forehead, and joins with supraorbital & frontal.
- **Post. Temporal** – The larger. Upwards & backwards, and joins with posterior auricular & occipital.

Gives off before its division:

- **Twigs** – To parotid gland & temporo-maxillary articulation.
- **Transverse Facial** – Forwards through parotid gland, and across face between Steno's duct & zygoma; joins with facial & infraorbital.
- **Middle Temporal** – Through temporal fascia to temporal muscle, joining with deep temporal branches of internal maxillary. Often gives off
  - Orbital Branch – To outer angle of orbit along upper border of zygoma & between the two layers of temporal fascia.
- **Ant. Auricular** – Two or three small branches to external ear.

INTERNAL MAXILLARY — The larger.

Commences in substance of parotid gland behind neck of condyle.

May be divided into three portions:

FIRST or MAXILLARY PORTION — Forwards beneath tendon of external pterygoid, and between neck of condyle & internal lateral ligament of jaw, crossing inferior dental nerve.

Gives off **Tympanic, Middle meningeal, Small meningeal, Inferior dental.**

SECOND or PTERYGOID PORTION — Forwards & upwards on outer surface of external pterygoid, between it & temporal muscle.

Gives off **two Deep temporal, Masseteric, Pterygoid, & Buccal.**

THIRD or SPHENO-MAXILLARY PORTION — Into spheno-maxillary fossa between the two heads of external pterygoid.

Gives off **Alveolar, Infraorbital, Vidian, Pterygo-palatine, Sup. or descending palatine, Nasal or Spheno-palatine.**

Sometimes the artery passes behind, and along inner surface of, external pterygoid muscle, between it & internal pterygoid.

BRANCHES of the INTERNAL MAXILLARY.

Tympanic – Through Glaserian fissure to tympanum, where joins with stylo-mastoid.

Middle or Great Meningeal – Through foramen spinosum, and divides into:

- Anterior Branch – Across great wing of sphenoid to groove or canal on anterior inferior angle of parietal, and divides into numerous branches to dura mater & skull.
- Posterior Branch – Crosses squamous portion of temporal bone, and divides into similar branches. Gives twigs to facial nerve through hiatus Fallopii, which twigs join with stylo-mastoid.

Small Meningeal – Arises frequently from preceding; through foramen ovale to dura mater of middle fossa.

Inferior Dental – With inferior dental nerve, similarly dividing opposite first bicuspid tooth into *incisor* & *mental branches*, and likewise giving off

- *Mylo-hyoid branch* – Along mylo-hyoid groove to mylo-hyoid muscle.

Deep Temporal – Two, anterior and posterior. Ascend between temporal muscle & pericranium.

Pterygoid – Vary in number and precise mode of origin.

Masseteric – Through sigmoid notch to masseter.

Buccal – Forwards upon buccinator to structures of cheek, joining with facial.

Alveolar – Descends upon tuberosity of superior maxilla, and divides into numerous branches to molar teeth, gums & lining membrane of antrum.

Infraorbital – Through infraorbital canal with superior maxillary nerve. Sends small twigs into orbit, and others to front teeth through canals in anterior wall of antrum, and divides beneath levator labii superioris into:

- *Ascending branches* – To inner angle of eye, where they join with nasal;
- *Descending branches* – To upper lip; join with transverse facial, superior coronary & buccal.

Vidian – With vidian nerve through vidian canal to upper part of pharynx & Eustachian tube; gives a twig to tympanum.

Pterygo-Palatine – With pharyngeal or pterygo-palatine nerve through pterygo-palatine canal to upper part of pharynx & Eustachian tube.

Superior or Descending Palatine – Descends with anterior or great palatine nerve through posterior palatine canal, sending twigs to soft palate. Forwards in groove on hard palate, giving twigs to mucous membrane & gums, and ascends through incisor foramen to join artery of septum.

Nasal or Spheno-Palatine – Through spheno-palatine foramen with superior nasal & naso-palatine nerves, and divides into:

- Internal Branch or Artery of Septum – Downwards & forwards along septum, and joins with termination of descending palatine.
- External Branches – Two or three to mucous membrane of outer wall of nose, and to ethmoidal & sphenoidal cells & Antrum.

INTERNAL CAROTID ARTERY

Commences at bifurcation of common carotid opposite upper border of thyroid cartilage & in the so-called superior carotid triangle. It is at first very superficial, being covered only by thin anterior border of sterno-mastoid, platysma & fascia, and lying on outer side of, & rather behind, external carotid artery.

May be divided into cervical, petrous, cavernous & cerebral portions.

CERVICAL PORTION — Ascends vertically to carotid foramen, passing (as does also external carotid)

BENEATH – Digastric & stylo-hyoid muscles, occipital artery, hypoglossal nerve, & parotid gland, – then ascending beneath, and being separated from external carotid by,

Stylo-glossus & -pharyngeus & the styloid process, the glosso-pharyngeal nerve and sometimes the pharyngeal branch of the vagus.– Its deep relations are:

ON INNER SIDE – Pharynx, tonsil, ascending pharyngeal art., superior laryngeal n.

BEHIND – Rectus capitis anticus major & transverse processes of the three upper cervical vertebræ; – superior cervical ganglion & main trunk of sympathetic, and superior laryngeal nerves.

BEHIND & EXTERNALLY – Internal jugular vein, and, lying between & behind the two vessels, the pneumogastric nerve.

Usually gives off no branches.

PETROUS PORTION — Ascends in carotid canal in front of tympanum, being surrounded by carotid & cavernous plexuses, and then curves forwards & inwards. – Sends a small

Tympanic Branch – To tympanum through a minute foramen in posterior wall of carotid canal.

CAVERNOUS PORTION — Ascends to sphenoid bone, and then runs forwards in cavernous groove, lying in inner wall of cavernous sinus, by lining membrane of which it is covered, and being, on its outer side, crossed by 6th nerve and more distantly related to 3rd, 4th, & ophthalmic branch of the 5th.

Gives off:

Ophthalmic Artery – Vide next Tablet.

Arteriæ Receptaculi – Several, small, to walls of cavernous sinus & dura mater.

CEREBRAL PORTION — Ascends between optic nerve & anterior clinoid process, perforates dura mater of roof of sinus, receives sheath from arachnoid, and after giving off **Post. Communicating & Ant. Choroid,** divides opposite inner extremity of fissure of Sylvius into

Ant. & Middle Cerebral – Vide next Tablet.

Ant. Choroid Artery – Arises from internal carotid. or sometimes from middle cerebral.

Backwards through lateral part of transverse fissure of brain to descending cornu of lateral ventricle, and supplies choroid plexus.

OPHTHALMIC ARTERY

Arises from internal carotid as that vessel emerges from cavernous sinus between optic nerve & anterior clinoid process.

Through optic foramen below & on outer side of optic nerve.

Over optic nerve, and forwards beneath superior oblique to anterior superior angle of orbit, where divides into frontal & nasal.

BRANCHES — May be divided into:

ORBITAL GROUP:

Lachrymal – With lachrymal nerve & above external rectus to lachrymal gland & upper eyelid. Gives off small malar & temporal branches, which perforate temporal bone to temporal fossa & cheek.

Supraorbital – With frontal nerve & above the muscles to supraorbital foramen, where divides into superficial & deep branches to integument & muscles of forehead & pericranium.

Ethmoidal – Anterior & posterior. Through anterior & posterior ethmoidal foramina (former with nasal nerve), giving branches to ethmoidal cells & dura mater, and then through foramina in cribriform plate of ethmoid to septum & outer wall of nose.

Palpebral – Superior & inferior. Encircle eyelids near free margin & beneath orbicularis, and anastomose with infraorbital & with orbital branch of temporal.

Frontal – From orbit at its superior internal angle to skin & muscles of forehead & pericranium, joining with supraorbital.

Nasal – Above tendo oculi, and divides into dorsalis nasi to dorsum of nose and anastomotic branch to angular branch of facial.

OCULAR GROUP:

Muscular – Very variable, usually divided into:

SUPERIOR – Smaller, to levator palpebræ superioris, superior rectus & superior oblique;

INFERIOR – Larger, to inferior oblique & the other recti, and gives off most of the anterior ciliary arteries.

Ciliary – May be divided into:

SHORT POSTERIOR – Surround optic nerve, and through sclerotic a line or two from the nerve to ciliary processes & choroid.

LONG – Two. Through back part of sclerotic, and between sclerotic & choroid on either side of eyeball to ciliary body, where bifurcate and form great arterial circle of iris, from which small twigs converge to free margin of iris forming lesser arterial circle.

ANTERIOR – Chiefly from muscular. Through sclerotic a line or two from margin of cornea to great arterial circle of iris.

Centralis Retinæ – Pierces optic nerve, and forwards in its substance to retina. In fœtus a small branch passes forwards through vitreous body to posterior part of capsule of lens.

VERTEBRAL ARTERY

Arises from upper & back part of first portion of subclavian.

Upwards & backwards to foramen in transverse process of 6th cervical vertebra, passing beh vasculo-nervous bundle of the neck and more particularly behind inferior thyroid arter internal jugular vein, and then between scalenus anticus & longus co

Upwards through the series of foramina in the transverse processes as far as upper border of a with the vertebral vein and a plexus of the sympathetic, the artery lying between the v which is in front, and the cervical nerves which emerge behind from the intervertel foram

Upwards & outwards to, and then through, foramen in transverse process of atlas.

Backwards & inwards behind lateral mass in groove on posterior arch of atlas, lying in the triangular space between the recti & obliqui muscles, and being crossed by the posterior bra of the suboccipital nerve and covered by the comple

Pierces posterior occipito-atloid ligament, and enters the skull through the foramen magnum

Winds round medulla oblongata between hypoglossal nerve and anterior root of suboccipi ascends obliquely between anterior surface of medulla oblongata & basilar process, joins its fellow opposite lower border of pons Varolii to form basilar tr

BRANCHES — Are cervical & cranial.

CERVICAL:

Muscular – Several, small, to the deep muscles of the neck.

Lateral Spinal – Through intervertebral foramina, and divide into:

Ant. Branch – To posterior surface of bodies of vertebræ;

Post. Branch – To roots of nerves, cord & its membranes.

CRANIAL:

Posterior Meningeal – Two or three, small, to dura mater of cerebellar foss

Posterior & Anterior Spinal – Arise respectively behind upper part of and in front of med

The two posterior descend behind the roots of the spinal nerves;

The two anterior unite into a single trunk, which descends along mi line of

Both join with, and are reinforced by, the numerous spinal branches der from the vertebral, ascending cervical, inferior thyroid, the interco lumbar, ilio-lumbar and lateral sacral; and are thus each of them tinued as small tortuous vessels, or rather as a series of inoscula vessels, down to the extremity of the cord, where they resolve into t to cauda eq

Posterior Inferior Cerebellar – Backwards round medulla between pne gastric & spinal accessory nerves, and over restiform body to me fissure or valley on under surface of cerebellum. Gives off an offs under surface of cerebral hemisphere and twigs to choroid plexus of vent

BASILAR ARTERY

Formed by junction of the two vertebral arteries opposite lower border of pons Varolii, and ext to upper border of the s

BRANCHES:

COLLATERAL:

Transverse Arteries of the Pons – Directly outwards over pons. One ac panies auditory nerve into internal auditory meatus, and becomes auditory ar

Anterior Inferior Cerebellar – Along crus cerebelli to anterior part of u surface of cerebel

Superior Cerebellar – Winds round crus cerebri with 4th nerve to upper su of cerebellum and gives twigs to velum interposi

TERMINAL:

Posterior Cerebral – Two. Vide arteries of base of brain.

RTERIES of the BASE of the BRAIN.

Are the anterior & middle cerebral branches of the internal carotid and the posterior cerebral of the basilar, which are joined together by the anterior & posterior communicating.

Anterior Cerebral – Anterior & smaller of the branches of bifurcation of internal carotid opposite inner extremity of fissure of Sylvius.

Forwards & inwards towards longitudinal fissure, being connected with each other by Anterior Communicating, – A small branch about two lines in length.

Round genu and along upper surface of corpus callosum, and join with posterior cerebral. Give off small branches to anterior perforated space and to inner & under surfaces of frontal lobe.

Middle Cerebral – The larger of the two terminal branches of internal carotid.

Forwards & outwards along fissure of Sylvius, giving twigs to anterior perforated space, and divides into branches to pia mater of frontal, parietal & temporo-sphenoidal lobes, and to central lobe or Island of Reil. – Sometimes gives off anterior choroid.

Posterior Communicating – Very variable in size.

From back part of internal carotid just before its bifurcation.

Backwards parallel to its fellow, and inosculates with posterior cerebral.

Posterior Cerebral – Two; terminal branches of basilar.

Forwards and outwards for a short distance giving numerous branches to posterior perforated space, and join posterior communicating.

Backwards & outwards on crura cerebri in front of 3rd nerve, and, curving slightly inwards, divide into numerous branches to inner, under, & outer surfaces of occipital lobe.

CIRCLE OF WILLIS — Is formed in front, laterally & behind respectively by:

Anterior cerebral arteries joined by the *anterior communicating,*
Trunks of internal carotids & *posterior communicating,*
Posterior cerebral & *basilar.*

Within the circle of Willis are comprised from before backwards the lamina cinerea, optic commissure, tuber cinereum with the infundibulum, corpora albicantia & posterior perforated space.

ABDOMINAL AORTA

Curves slightly backwards & to the left from aortic opening in front of 12th d al vertebra to a little to the left of 4th lumbar vertebra, where it di es into the two common i s.

RELATIONS:

In Front - Lesser omentum, stomach, cœliac axis, solar plexus;
Splenic vein, pancreas, left renal vein;
Transverse portion of duodenum, mesentery, aortic plexus.
Behind - Vertebræ, left lumbar veins, receptaculum chyli, thoracic du
To the Right - Inferior vena cava, vena azygos major, receptaculum yli, thoracic duct, right semilunar gan on.
To the Left - Cord of sympathetic, left semilunar ganglion.

BRANCHES — Phrenic, Cœliac Axis, Superior Mesenteric;
Suprarenal, Renal, Spermatic;
Inferior Mesenteric, Lumbar, & Sacra-Media.

RANCHES of the ABDOMINAL AORTA—1st Tablet.

Inferior Phrenic – Two. Arise separately or by a common trunk either from cœliac axis,or from aorta immediately above the latter.
Upwards and outwards behind œsophagus on left side, behind vena cava on right side, to central tendon of diaphragm, and divide into:
Internal Branch – To front part of diaphragm communicating with its fellow & with musculo-phrenic.
External Branch – To side of thorax, communicating with intercostals.
Gives off small *superior capsular branches* to suprarenal capsule.

Cœliac Axis – Vide next Tablet.

Superior Mesenteric – Vide next Tablet but one.

Suprarenal – Two. Small in adult, but in fœtus as large as renal. To suprarenal capsules, anastomosing with capsular branches of phrenic & renal.

Renal or Emulgent – Two. Large, from sides of aorta just below superior mesenteric.
Nearly horizontally outwards behind renal vein, and divide, each of them, into four or five branches, which penetrate into hilum of kidney in front of pelvis. – Give off small *inferior capsular branches* to suprarenal capsule, and twigs to pelvis & ureter.
Right artery passes behind inf. vena cava, is longer than left one, and lies a little lower.
Renal arteries vary considerably in coincidence with variations of kidneys in situation, size, and number. – They may arise from front of aorta near its bifurcation, or from common or internal iliac; – they may divide into branches sooner than usual, or may be replaced by several arteries which arise separately from side of aorta; – one may be wanting, or there may be a supernumerary artery corresponding to a supernumerary kidney.

Spermatic – Two; long & slender. From front of aorta a little below renal.
Downwards and outwards beneath peritoneum to brim of pelvis crossing psoas & ureter and, on right side, inferior vena cava.
Forwards in front of external iliac artery to internal abdominal ring, being crossed on right side by termination of ileum, on left side by sigmoid flexure of colon.
Through inguinal canal and down to back of testis with other constituents of spermatic cord, becoming tortuous near its termination, and giving twigs to epididymis, which twigs join with artery of vas deferens; pierces tunica albuginea to substance of testis.
OVARIAN ARTERY – In female. Same course down to brim of pelvis, then passes downwards & inwards to attached margin of ovary between layers of broad ligament of uterus; joins with uterine on side of uterus; gives branches to Fallopian tube and twigs to round ligament, which twigs are sometimes continued through inguinal canal to integument of labium & groin.
Both these arteries are short during first part of fœtal life, when testes & ovaries lie just below kidneys, and become elongated only when these organs descend into pelvis.

Inferior Mesenteric – Vide next Tablet but one.

Lumbar – Usually four; from back of aorta.
Round bodies of lumbar vertebræ beneath psoas, the two upper ones passing also beneath pillars of diaphragm, and those of right side beneath inferior vena cava; and divide between transverse processes into:
Abdominal Branch – Behind quadratus lumborum (the lowest one sometimes in front), and beneath abdominal muscles, joining with epigastric, internal mammary, intercostals, ilio-lumbar & circumflex iliac.
Dorsal Branch – Sends a spinal branch through intervertebral foramen to cauda equina & posterior surface of bodies of vertebræ, and passes backwards to muscles & integument of back.

Sacra Media – Small; from back of aorta at point of bifurcation.
Descends upon middle of sacrum, anastomosing with both lateral sacral.

BRANCHES of the ABDOMINAL AORTA—2nd Tablet.

CŒLIAC AXIS.

Short thick trunk, from front of aorta between pillars of diaphragm.

Forwards above pancreas and between lobus Spigelii & right semilunar ganglion on the right, a left semilunar ganglion & cardiac end of stomach on the left, for about half an inch, a divides in

GASTRIC, OR CORONARIA VENTRICULI – The smallest.

Upwards and to the left to cardiac orifice of stomach.

Along lesser curvature between layers of lesser or gastro-hepatic omentum to pylor where inosculates with pyloric branch of hepatic; gives branches to both s faces of stoma

HEPATIC – Intermediate in size in the adult; the largest in the fœtus.

Upwards and to the right in front of foramen of Winslow, between the two layers along right border of lesser or gastro-hepatic omentum, – ductus comm choledochus lying to the right, and the vena portæ behind, – and divides transverse fissure of liver into two branches, which accompany division vena portæ & hepatic duct to right & left lobes. Gives off branch

Pyloric – To pylorus, and along lesser curvature, inosculating with gastric.

Gastro-duodenalis – Large; downwards behind duodenum, and divides int

Gastro-epiploica dextra – Along greater curvature of stomach betw layers of great omentum, giving branches to both surfaces of stom and to omentum, and inosculates with gastro-epiploica sinis

Pancreatico-duodenalis Superior – Descends between pancreas and denum ,and anastomoses with inferior pancreatico-duodenali branch of superior mesent

Cystic – Arises from right division. – Upwards to neck of gall bladder, ramifies on its under surface, and between it & li

SPLENIC – The largest.

Tortuous course to the left behind upper border of pancreas and above splenic and divides into numerous branches which enter hilum of sple Gives

Pancreaticæ parvæ – Numerous, small.

Pancreatica magna – From left to right along posterior surface of panc

Vasa brevia – From five to seven in number; between layers of gastro-spl omentum to splenic end of stom

Gastro-epiploica sinistra – Along greater curvature of stomach betv layers of great omentum, giving branches to both surfaces of stoma to omentum, and inosculating with gastro-epiploica de

RANCHES of the ABDOMINAL AORTA—3rd Tablet.

SUPERIOR MESENTERIC ARTERY

From front of aorta just below cœliac axis and behind splenic vein & pancreas.
Forwards between pancreas & transverse portion of duodenum, and crosses front of the latter.
Curves downwards to the right between layers of mesentery to right iliac fossa, and inosculates with its own ileo-colic branch.

BRANCHES:

Inferior Pancreatico-duodenal – Given off behind pancreas.
Ascends along concave border of duodenum and joins with superior pancreatico-duodenal.

Vasa intestini tenuis – Ten or twelve or more, and arise from convex side of artery.
Descend between layers of mesentery and divide each of them into two branches, by junction of each of which with the neighbouring branch, a first series of arches is formed, to which 2nd, 3rd, 4th, & even 5th rapidly diminishing tiers succeed, the terminal branches encircling the intestine and ramifying in its coats.

Ileo-colic – The lowest branch from concavity.
Between layers of mesentery towards ileo-colic valve, and divides into:
Ascending Branch – To beginning of colon, and inosculates with colica dextra.
Descending Branch – To end of ileum, and inosculates with termination of superior mesenteric, both branches forming arches as above.

Colica dextra – From middle of concavity.
Beneath peritoneum and in front of right kidney to middle of ascending colon, and divides into
Ascending & Descending Branches, – Which inosculate respectively with the colica media & the ileo-colic, also forming arches as above.

Colica media – From upper part of concavity.
Between layers of transverse meso-colon towards middle of transverse colon, dividing as preceding arteries, and similarly inosculating with colica dextra & colica sinistra.

INFERIOR MESENTERIC ARTERY

From left side of aorta one or two inches above bifurcation.
Descends along left side of aorta and front of psoas towards left iliac fossa, and then, under the name of superior hæmorrhoidal, curves to the right in front of left common iliac & ureter, and descends into the pelvis behind rectum, between layers of meso-rectum.

BRANCHES:

Colica sinistra – Beneath peritoneum and in front of left kidney to middle of descending colon, and divides into
Ascending & Descending Branches, – Which inosculate respectively with the colica media and the sigmoid artery, and supply intestine as above described.

Sigmoid Artery – Across psoas to sigmoid flexure of colon, and divides into two branches, which inosculate with colica sinistra and sup. hæmorrhoidal.

Superior hæmorrhoidal – The continuation of the inferior mesenteric.
Follows course above described, and divides opposite middle of sacrum into two branches, which descend on each side of rectum to near its lower end, and join with middle hæmorrhoidal.

COMMON ILIAC ARTERY.

Downwards & outwards from bifurcation of aorta a little to the left of 4th lum vertebra to opposite sacro-vertebral articulation (some Authors say opposite sacro- synchondrosis), where it divides into external & internal iliacs. Is about two inc long, the right artery being slightly the lon

RELATIONS :

Right Side:

In Front – Small intestine, peritoneum, sympathetic nerve, ur near bifurcat

Behind – Both common iliac veins.

Outer Side – Right common iliac vein, inferior vena cava, p mu

Left Side:

In Front – Same, plus rectum & superior hæmorrhoidal artery.

Outer Side – Psoas.

Left Common Iliac Vein – Lies at first on inner side of its artery, and passes beneath artery of right

Right Common Iliac Vein – Lies at first behind its artery, and then o outer

BRANCHES — Very small & not named, sometimes **Renal & Ilio-lumbar.**

XTERNAL ILIAC ARTERY.

Downwards & outwards along inner border of psoas, extending from bifurcation of common iliac opposite sacro-vertebral articulation (some Authors say opposite sacro-iliac synchondrosis) to beneath Poupart's ligament midway between anterior superior spine of ilium & symphysis pubis, where it becomes femoral artery. Rather larger in the adult than internal iliac; half the size in the fœtus.

RELATIONS: —

In Front – Intestine, peritoneum, thin layer of fascia derived from the iliac; spermatic vessels & nerves, genital branch of genito-crural nerve, circumflex iliac vein, sometimes ureter near origin.

Behind on Right Side – External iliac vein, which lies on inner side at femoral arch.

On Inner Side – External iliac vein, & vas deferens.

On Outer Side – Iliac fascia & psoas muscle.

Left External Iliac Vein lies altogether on inner side of its artery.

Right External Iliac Vein lies at first on inner side of its artery, and then behind it.

BRANCHES: —

Epigastric – Somewhat the larger. From front of external iliac a few lines above Poupart's ligament.

Descends slightly to reach level of the ligament.

Ascends obliquely upwards & inwards in subperitoneal areolar tissue, passing behind inguinal canal & along lower & inner boundaries of internal abdominal ring, and hooking round vas deferens in the male, round round ligament in the female.

Pierces sheath of rectus between its middle & lower thirds, and ascends behind the muscle, dividing into muscular & cutaneous branches, which anastomose with lower intercostals, lumbar, superior epigastric of internal mammary, & superficial epigastric of femoral. – Gives off branches:

Cremasteric – Small, descends upon spermatic cord and supplies cremaster; anastomoses with spermatic.

Pubic – Usually small; descends behind pubes on inner side of femoral ring, and anastomoses with obturator. Sometimes greatly increased in size so as to form the origin, or one of the origins, of the obturator artery, which artery is then said to arise from the epigastric (Vide obturator artery). – The two epigastric veins unite into one trunk, which opens into the external iliac.

Circumflex Iliac – Somewhat the smaller. From outer side of external iliac near Poupart's ligament.

Upwards & outwards behind the ligament, and along anterior half of inner lip of crest of ilium, joining with gluteal.

Pierces transversalis, runs backwards between it & the internal oblique, and joins with ilio-lumbar. Gives off numerous muscular branches; one, rather large, ascends from anterior superior spine of ilium, and joins with the epigastric & lumbar. – The two circumflex iliac veins unite into one trunk, which crosses the external iliac artery and opens into the corresponding v.

INTERNAL ILIAC ARTERY.

Short thick trunk which extends from bifurcation of common iliac artery opposite sacr vertebral articulation (some Authors say opposite sacro-iliac synchondrosis) upper border of great sacro-sciatic foramen, near which it divides into anteri & posterior divisions.

Usually 1½ inches long, but its length may vary from ½ an inch to 3 inches.

Rather smaller in adult than the external iliac. Twice as large in fœtus: – Under t name of hypogastric artery, it then continues the common iliac along side bladder, and ascends to umbilicus where it becomes one of the umbilical arteri

RELATIONS:

In Front – Peritoneum, ureter.
Behind – Pyriformis, internal iliac vein, lumbo-sacral cord.
On Outer Side near Origin – Psoas & external iliac vein.

BRANCHES — Are given off as follows, from: –

ANT. DIVISION — Sup. Middle & Inf. Vesical, Middle Hæmo
rhoidal, and in female, Uterine & Vagina
Obturator, Sciatic, Pudic.

POST. DIVISION — Ilio-Lumbar, Lateral Sacral, Gluteal.

RANCHES of the INTERNAL ILIAC ARTERY—1st T.

BRANCHES FROM ANTERIOR DIVISION.

VISCERAL BRANCHES:

Vesical – Two or three; but other twigs pass to bladder from middle hæmorrhoidal, uterine, vaginal, & obturator.

SUPERIOR VESICAL – Is that part of hypogastric artery which extends to side of bladder, and which remains pervious after birth. Gives off *artery of vas deferens*, and the

MIDDLE VESICAL, – Which is often wanting.

INFERIOR VESICAL – Usually arises in common with middle hæmorrhoidal. To base of bladder, prostate, & vesiculæ seminales.

Middle Hæmorrhoidal – Joins with superior hæmorrhoidal branch of inferior mesenteric, and with inferior hæmorrhoidal branch of internal pudic.

Uterine – Downwards to neck of uterus, and then upwards in a tortuous course along side of body between folds of broad ligament; communicates with ovarian.

Vaginal – Descends upon vagina to neck of bladder & rectum.

NON-VISCERAL BRANCHES:

Obturator – Usually arises (2 cases out of 3) from anterior division or sometimes from posterior division of internal iliac. In one case in 3½ it arises from the epigastric, that is to say that its anastomotic branch with that artery is enormously increased in size while its proper root is proportionately diminished. Sometimes both roots are nearly equally developed (1 case in 72). Occasionally the artery arises from termination of external iliac.

In cases of abnormal origin from epigastric the obturator artery usually arises from near the root of the latter, and then descends into the pelvis close to the external iliac vein and on the outer side of the femoral ring. Sometimes, however, it arises from the epigastric higher up, that is to say at a distance from the root of the latter; it then passes inwards above the femoral ring and descends into the pelvis on the inner side of that ring behind Gimberat's ligament. It is in this latter case only that the obturator artery is exposed to be wounded in the operation for strangulated femoral hernia.

When it arises from the internal iliac it passes forwards along outer wall of pelvis below obturator nerve, giving off small iliac & vesical branches and a pubic branch which communicates on back of pubes with its fellow and with the epigastric.

Through upper part of obturator foramen, and divides into:

INTERNAL BR. – Round inner margin of obturator foramen; supplies obturator & adductor muscles, pectineus & gracilis and anastomoses with internal circumflex.

EXTERNAL BR. – Round outer margin of obturator foramen to interval between gemellus inferior & quadratus femoris, sends an articular branch to hip-joint through cotyloid notch, and anastomoses with external circumflex & sciatic arteries; supplies obturator externus & the lower external rotator muscles.

Sciatic – The largest of the two terminal branches of anterior division of internal iliac artery, and the largest branch of the artery after gluteal.

Downwards in front of pyriformis & sacral plexus, lying a little behind & to outer side of internal pudic.

Through great sacro-sciatic foramen below pyriformis and between great sciatic nerve & pudic vessels & nerve.

With small sciatic nerve over gemelli, obturator internus & quadratus femoris and in front of gluteus maximus.

Gives off branches:

MUSCULAR, ARTICULAR to hip-joint;

COCCYGEAL, INFERIOR GLUTEAL;

COMES NERVI ISCHIADICI – Long, slender; with, and subsequently within sheath of, great sciatic nerve to lower part of thigh.

Pudic – Vide next Tablet.

BRANCHES of the INTERNAL ILIAC ARTERY—2nd

PUDIC ARTERY.

The smaller of the two terminal branches of anterior division of internal iliac artery.

Descends in front of pyriformis & sacral plexus, lying to the inner side & a little in f it of sciatic ery.

With pudic nerve through lower part of great sacro-sciatic foramen below pyriformis or ner side of sciatic nerves & sciatic ery.

Winds round spine of ischium and re-enters pelvis through lesser sacro-sciatic foramen.

Forwards along outer wall of ischio-rectal fossa below pudic nerve, being covered by obt ator fascia, and lying at first 1½ inches above lower extremity of tuber ischii, but appro ing surface as it prog sses.

Pierces deep layer of deep perinæal fascia, and ascends along pubic arch between tl two layers of that fascia to near symphysis bis.

Pierces superficial layer of deep perinæal fascia, and divides into artery of corpus caver sum and dorsal artery of nis.

BRANCHES:

Inferior Hæmorrhoidal – Two or three, small. – Arise in ischio-recta ssa, which they cross to lower part of rectum nus.

Superficial Perinæal – Arises near transversus perinæi muscle, which it sses super ally.

Between accelerator urinæ & erector penis to skin of scrotum & rtos, or of ium.

Transverse Perinæal – Small, arises frequently from superficial perinæal.

Inwards below transversus perinæi to structures between bulb an nus.

Artery of the Bulb – Large and surgically important.

Inwards to bulb & Cowper's glands between the two layers of deep p ıæal scia.

May be small or even absent, or may be double. May arise earl and cross perinæum further back than usual, and would then l very liable to be divided in lateral lithotomy. May arise from an ac sory pudic, and then lie more forward and be altogether out of ıger.

Artery of the Corpus Cavernosum – Pierces crus penis, and runs f ards in corpus cavernosum by side of septum pectir rme.

Dorsal Artery of the Penis – Between crus and symphysis. Through sus sory ligament and forwards beneath skin on dorsum of penis to glans & p ouce.

ACCESSORY PUDIC ARTERY — Exceptional branch of internal iliac hich exists when pudic artery, being smaller than usual, fails to give off two terminal branches & sometimes even the artery of tl bulb.

Arises from near origin of pudic, passes forwards along base of bladder & upp part of prostate, pierces triangular ligament, and takes the place of termir portion of normal tery.

BRANCHES of the INTERNAL ILIAC ARTERY—3rd T.

BRANCHES FROM POSTERIOR DIVISION.

Ilio-Lumbar – Arises from upper part of posterior division.
Ascends beneath psoas to upper part of iliac fossa, where it divides into:

Lumbar Branch – To psoas & quadratus lumborum, communicating with last lumbar artery, and sending a small spinal branch through intervertebral foramen between last lumbar vertebra & sacrum;

Iliac Branch – To iliacus & ilium, and along crest anastomosing with circumflex iliac.

Lateral Sacral – Usually two, superior & inferior.
Downwards and inwards in front of pyriformis & sacral plexus, and along inner side of anterior sacral foramina, anastomosing with middle sacral and giving off

Dorsal Branches – Through anterior sacral foramina to contents of spinal canal, and then through posterior sacral foramina to skin & muscles on back of sacrum.

Gluteal – The largest branch of internal iliac, and the continuation of its posterior division.
Through great sacro-sciatic foramen above pyriformis, and then between latter muscle & gluteus medius, and divides into:

Superficial Branch – Gives off numerous branches to gluteus maximus & integument over sacrum;

Deep Branch – Forwards between glutei medius & minimus, and divides into:

Superior Division – Along upper border of gluteus minimus towards anterior superior spine of ilium, and joins with circumflex iliac.

Inferior Division – Crosses gluteus minimus towards great trochanter, and joins with ascending branches of external circumflex.

AXILLARY ARTERY

From outer border of first rib to lower border of tendons of teres major & latissimus do
being either straight or slightly curved upwards or downwards according to position
limb, and lying deeply at its origin & superficially at its terminati

May be divided into three parts:

First Part – Above pectoralis minor; rests upon thoracic wall.
Second Part – Behind pectoralis minor; passes obliquely from thorax to a
Third Part – Below pectoralis minor; lies on inner side of neck of humerus.

RELATIONS:

FIRST PART:

In front – Pectoralis major, costo-coracoid membrane; cephalic & a
mio-thoracic veins; external anterior thoracic ne
Behind & on Inner Side – First intercostal space, first digitation of
ratus magnus, posterior thoracic ne
On Inner Side & in Front – Axillary vein.
On Outer Side – Brachial plexus.

SECOND PART:

In Front – Pectorales major & minor.
Behind – Upper part of subscapularis & posterior cord of brachial ple
On Inner Side – Axillary vein & inner cord.
On Outer Side – Coraco-brachialis & outer cord.

THIRD PART:

In Front – Pectoralis major (except at lowest part), junction of the
heads of median ne
Behind – Lower part of subscapularis, tendons of teres major & latissi
dorsi, musculo-spiral & circumflex ne
On Inner Side – Axillary vein, inner head of median, ulnar, inte
cutaneous & lesser internal cutaneous ne
On Outer Side – Coraco-brachialis, outer head of median nerve, musc
cutaneous ne

BRANCHES of the AXILLARY ARTERY

Vary considerably in mode of origin, size & number. Are still usually described after Haller as being given off as follows, from

FIRST PART:

Sup. Thoracic — Small. Inwards along upper border of pectoralis minor, and then between latter muscle & pectoralis major; anastomoses with intercostales & internal mammary.

Acromio-thoracic — Short, thick, from fore part of artery. Forwards to upper border of pectoralis minor, and divides into branches:

- ACROMIAL – Join with suprascapular & with both circumflex.
- THORACIC – Two or three. To pectorales & serratus magnus, and join with intercostales & internal mammary.
- HUMERAL – One, rather large. Downwards with cephalic vein between pectoralis major & deltoid.

SECOND PART:

Long Thoracic or Ext. Mammary — Large branch. Along lower border of pectoralis minor to mamma, pectorales & serratus, and to axillary glands & subscapularis. Joins with the other thoracic & with subscapular.

Alar Thoracic — Small & often wanting. To axillary glands & cellular tissue.

THIRD PART:

Subscapular — The largest branch. Along lower border of subscapularis to lower angle of scapula, where joins with posterior scapular. Gives off twigs to surrounding muscles, and

- DORSALIS SCAPULÆ – Arises an inch & a half from origin of subscapular. Round outer border of scapula between teres major, teres minor & long head of triceps, and then between teres minor & the bone. Gives off:
  - *Branches* to subscapular fossa between subscapularis & bone; join with posterior- & suprascapular.
  - *Descending br.* between teres major & minor.
  - *Branches* to infraspinous fossa; join with posterior- & suprascapular.

Ant. Circumflex — The smaller. Outwards beneath coraco-brachialis, short head of biceps & deltoid, giving off twig to shoulder joint; joins with following & with acromial branch of acromio-thoracic.

Post. Circumflex — The larger. Through quadrangular space between teres major, teres minor, long head of triceps & humerus, and round neck of humerus beneath deltoid. Gives twigs to shoulder joint, and joins with preceding & with acromial branch of acromio-thoracic.

BRACHIAL ARTERY

Commences at lower border of tendons of teres major & latissimus dorsi.

Down inner & anterior aspects of arm in groove along inner border of coraco-brachialis & biceps, lying at first on inner side, and then in front of, humerus,– its more precise direction being marked by a line drawn from outer side of axilla to midway between condyles of humerus

Divides into radial & ulnar half an inch below bend of elbow, or opposite neck of radius.

RELATIONS:

ALONG THE ARM:

In front – Skin and fascia, inner border of coraco-brachialis & biceps; median nerve.

Behind – Long and inner heads of triceps, superior profunda artery & musculo-spiral nerve; coraco-brachialis, brachialis anticus.

On Inner Side – Skin & fascia, internal cutaneous nerve, basilic vein; ulnar nerve in upper part, median nerve in lower part.

On Outer Side – Coraco-brachialis & biceps, humerus in upper part.

AT BEND OF ELBOW:

In front – Skin, superficial fascia, median basilic vein, branches of anterior division of internal cutaneous nerve; bicipital or semilunar fascia

Behind – Brachialis anticus & elbow joint.

On Inner Side – Pronator radii teres, median nerve.

On Outer Side – Tendon of biceps, supinator longus, musculo-cutaneous & musculo-spiral nerves

BRANCHES:

Muscular — Irregular, to coraco-brachialis, biceps & brachialis anticus.

Nutritious — From near middle of artery. Enters nutrient canal near insertion of coraco-brachialis, and descends towards lower extremity of the bone

Sup. Profunda — From upper part of artery. With musculo-spiral nerve in groove of same name between inner & outer heads of triceps, and then between supinator longus & brachialis anticus, where joins with radial recurrent. Gives off muscular branches, and an articular branch to back of elbow joint, which joins with interosseous & posterior ulnar recurrent, and with inferior profunda or anastomotica magna.

Inf. Profunda — Small, from near middle of artery. With ulnar nerve through internal intermuscular septum, and then between inner condyle & olecranon; anastomoses with posterior ulnar recurrent & anastomotica magna.

Anastomotica Magna — From lower part. Through internal intermuscular septum, and round back of humerus forming an arch above olecranon fossa with articular branch of superior profunda. Joins with anterior & posterior ulnar recurrent & with inferior profunda.

RADIAL ARTERY

The smaller branch of bifurcation of brachial half an inch below bend of elbow or opposite neck of radius.
Down front of outer side of forearm to a little to inner side of styloid process of radius.
Round outer side of carpus beneath extensor tendons of thumb.
Through upper part of first interosseous space between the two heads of abductor indicis.
Over bases of metacarpal bones & interossei, and beneath flexor tendons, lumbricales & nerves to base of 5th metacarpal bone, where inosculates with communicating branch of ulnar, forming deep palmar arch. Lies a finger's breadth above level of superficial palmar arch.

RELATIONS in FOREARM:

In Front – Skin, superficial fascia, deep fascia, supinator longus.
Behind – Tendon of biceps, supinator brevis, pronator radii teres, flexor sublimis digitorum, flexor longus pollicis, pronator quadratus, lower end of radius.
On Outer Side – Supinator longus, radial nerve in middle third.
On Inner Side – Pronator radii teres, flexor carpi radialis.

BRANCHES:

IN FOREARM:

Radial recurrent — From upper part. Between brachialis anticus & supinator longus, and anastomoses with interosseous recurrent & superior profunda.

Muscular — Numerous, to muscles on either side.

Ant. carpal — From lower part. Joins with anterior carpal branch of ulnar beneath deep flexor tendons; gives twigs to articulations of carpus.

Superficialis volæ — From termination of artery in forearm. Small, and ends in muscles of thumb; or of more considerable size, and joins with & completes superficial palmar arch.

ON BACK OF WRIST:

Post. carpal — Over back of carpus beneath extensor tendons. Joins with posterior carpal branch of ulnar to form POSTERIOR CARPAL ARCH, which anastomoses with termination of anterior interosseous artery of forearm, and gives off:

Dorsal Interosseous Arteries of Third & Fourth Spaces – Anastomose at upper part of interosseous spaces with perforating branches of deep palmar arch. – Are usually exhausted in sheaths of tendons, interossei & integument over back of first phalanges, but are sometimes larger than usual, and are then prolonged upon dorsum of fingers in the shape of dorsal digital branches similar to those of thumb & outer side of index, and of toes.

Metacarpal, or Dorsal Interosseous Art. of Second Space — Arises beneath extensor tendons of thumb, sometimes in common with posterior carpal, and is similar to, but larger than, the foregoing interosseous arteries.

Dorsales pollicis
Dorsalis indicis } Correspond together to a first dorsal interosseous artery. The former supplies dorsal digital branches to both sides of back of thumb, the latter forms the dorsal digital branch of outer side of back of index.

IN PALM OF HAND:

Princeps pollicis
Radialis indicis } Correspond together to a first palmar interosseous artery. The former supplies palmar digital branches to both sides of front of thumb, the latter forms the palmar digital branch of outer side of front of index.

Perforating — Three. Through upper part of three inner interosseous spaces, and anastomose with corresponding dorsal interosseous arteries.

Deep palmar interosseous — Usually three or four, but very variable in size & number. Descend in front of interosseous spaces, join with superficial palmar interosseous branches from superficial palmar arch, and then bifurcate to form palmar digital branches to 3½ fingers on inner side of hand.

ULNAR ARTERY

The larger branch of bifurcation of brachial half an inch below bend of elbow, or opposit neck of radius

Deeply to near middle of inner border of forearm, lying upon brachialis anticus & flexo profundus and beneath median nerve and all the superficial muscles except flexo carpi ulnaris, and being at a distance from ulnar nerve

Beneath skin and fascia only along front of inner border of forearm, lying, with ulnar nerv on its inner side, between flexor carpi ulnaris & flexor sublimis digitorum

Over anterior annular ligament on outer side of pisiform bone & slightly in front of nerve.

Crosses palm of hand beneath skin & fascia and in front of flexor tendons & divisions o median & ulnar nerves, forming superficial palmar arch. This arch lies on a leve with lower border of abducted thumb, a finger's breadth below deep palmar arch and usually joins with superficialis volæ or radialis indicis, or sometimes wit princeps pollicis

BRANCHES:

Ant. ulnar recurrent — Small. Between pronator radii teres & brachiali anticus, and anastomoses with inferior profunda & anastomotica magna

Post. ulnar recurrent — Larger. Beneath flexor sublimis, and then betwee olecranon & inner condyle beneath flexor carpi ulnaris, and anastomose with interosseous recurrent, and with inferior profunda & anastomotic magna

Interosseous — Thick, an inch in length, to upper border of interosseous membran where divides into

Ant. Interosseous — Down front of interrosseous membrane with corres ponding branch of median nerve and between flexors longu pollicis & profundus digitorum. Behind pronator quadratus, an through lower part of interosseous membrane to back of carpu where joins with posterior interosseous & posterior carpal arch. Gives off a long slender twig to median nerve, and their nutrie arteries to radius & uln

Post. Interosseous — Between interosseous membrane & oblique or roun ligament, and then between superficial & deep muscles of back forearm to back of carpus, where anastomoses with termination anterior carpal & with posterior carpal arch; gives o

Interosseous Recurrent — Beneath anconeus & supinator brevis interval between olecranon & external condyle, and anast moses with superior profunda & posterior ulnar recurren

Ant. Carpal — Joins with anterior carpal branch of radial beneath deep flex tendons; gives twigs to articulations of carpu

Post. carpal — Beneath tendon of flexor carpi ulnaris, and over back of carp beneath extensor tendons, joining with posterior carpal branch of radia and forming posterior carpal arch (Vide Radial artery). Sends a sma branch along metacarpal bone of little finge

Communicating — Between abductor & flexor brevis minimi digiti, and joi with termination of radial to complete deep palmar arc

Superficial palmar interosseous (Digital) — Usually four, but rather var able in size & number. Descend with terminal branches of median & uln nerves, first in front of, and then between, the flexor tendons (and on inn side of the innermost), and join with deep palmar interosseous branch from deep palmar arch. The trunks thus formed divide at clefts betwee fingers to form digital branches to 3½ fingers on inner side of han

FEMORAL ARTERY

Commences beneath Poupart's ligament midway between antero-superior spine of ilium & symphysis pubis, and a little to inner side of head of femur.
Passes down front & inner side of thigh, being at first at a distance from, and then close to, the shaft of the bone.
Terminates at junction of middle and lower thirds of thigh, becoming popliteal artery in opening in lower part of adductor magnus. – Some Authors describe a *common* femoral artery descending as low down as the origin of the *deep* femoral, the main trunk below this branch being called the *superficial* femoral.
Its direction is marked by a line drawn from midway between antero-superior spine of ilium and symphysis pubis to inner side of inner condyle of femur.

RELATIONS — Must be examined in Scarpa's triangle, or in upper third, and in middle third of thigh.

IN SCARPA'S TRIANGLE — The artery divides the triangle into two nearly equal parts, and has

In Front – Skin, superficial fascia, fascia lata (except opposite saphenous opening, where latter is replaced by cribriform fascia), sheath; internal cutaneous nerve & filaments of crural branch of genito-crural n.; inguinal lymphatic glands.
Behind – Posterior part of sheath; psoas, pectineus, adductor longus; profunda artery & vein.
On Inner Side at Upper Part – Femoral vein, which becomes posterior below.
On Outer Side – Psoas muscle, anterior crural & long saphenous nerves.

IN MIDDLE THIRD OF THIGH — It lies behind sartorius in Hunter's canal, –a deep depression between vastus internus & tendons of adductors longus & magnus closed in anteriorly by a band of fascia,–and has femoral vein behind it & to its outer side, and long saphenous nerve to its outer side & in front.

BRANCHES:

Superficial Epigastric — Arises close to Poupart's ligament. Through saphenous opening, and then upwards and inwards in superficial fascia of abdomen, and anastomoses with deep epigastric & internal mammary.

Superficial Circumflex iliac — Arises close to Poupart's ligament. Pierces fascia lata on outer side of saphenous opening, and upwards & outwards below Poupart's ligament to crest of ilium. Anastomoses with circumflex iliac & gluteal arteries.

Superficial or Sup. External Pudic — Arises near preceding. Inwards through saphenous opening, and then across spermatic cord or round ligament to integument of abdomen, penis & scrotum, or labia.

Deep or Inf. External Pudic — Arises with or near preceding. Inwards beneath fascia lata, which it pierces opposite pubes, to integument of perinæum & to scrotum or labia.

Profunda Femoris, or Deep Femoral — Vide next Tablet.

Muscular Brs. — Numerous, and given off along entire course.

Anastomotica magna — Arises in Hunter's canal. Descends upon tendon of adductor magnus, and divides into:
Superficial Branch – With internal saphenous nerve to integument of inner side of knee.
Deep Branch – Through substance of vastus internus to inner side of front of knee, and anastomoses with superior internal & superior external articular arteries & with recurrent branch of tibial.

COLLATERAL CIRCULAT. — Is reestablished after ligature of the COMMON FEMORAL through the gluteal, ilio-lumbar & circumflex iliac arteries, which join with the external circumflex, through the obturator & sciatic, which join with the internal circumflex, through the comes nervi ischiadici, which join with the terminal & perforating branches of the profunda . – After ligature of the SUPERFICIAL FEMORAL it is reestablished mainly through the deep femoral & its perforating branches, which join with the articular branches of the popliteal.

DEEP FEMORAL ARTERY

From outer & back part of femoral one or two inches below Poupart's ligament, and nearly equals superficial femoral in size.

Passes: –

Downwards & outwards in front of iliacus, on outer side of femoral artery;

Downwards & inwards behind femoral vessels & profunda vein, and in front of pectineus:

Backwards between pectineus & adductor longus;

Downwards behind adductor longus, in front of adductors brevis & magnus; – and ends in a small branch, which perforates lower part of adductor magnus to muscles of back of thigh, and anastomoses with inferior perforating & with branches of popliteal.

BRANCHES:

EXTERNAL CIRCUMFLEX — The larger. From outer side of artery close to its origin.

Outwards between branches of anterior crural nerve and beneath sartorius & rectus, and divides into branches:

Ascending – Beneath tensor vaginæ femoris, and anastomose with gluteal & circumflex iliac.

Descending – Usually three or four & of considerable size. – Beneath rectus muscle to vasti, principally the external. One large branch descends with nerve to vastus externus as low as knee, and anastomoses with articular branches of popliteal.

Transverse – Smaller. Wind round femur below trochanter major in substance of vastus externus, and anastomose with internal circumflex, sciatic & superior perforating.

INTERNAL CIRCUMFLEX — The smaller. From inner & back part close to origin.

Backwards between pectineus & psoas, and winds round inner side of neck of femur to interval between quadratus femoris and adductor magnus, and anastomoses with external circumflex, sciatic & superior perforating. Gives off branches:

Ascending – To adductor muscles, gracilis & obturator externus; anastomoses with obturator.

Descending – Between adductors brevis & magnus, which it supplies.

Articular – Into acetabulum through notch beneath transverse ligament; supplies adipose tissue, and sends twigs along round ligament to head of femur.

PERFORATING — Usually three & of good size. – Arise behind adductor longus, above, in front of, and below, adductor brevis, and pass to back of thigh, the

SUPERIOR, — Perforating the adductor magnus above the brevis (some-perforating adductor brevis also);

MIDDLE, — Perforating both these adductors;

INFERIOR, — Perforating the adductor magnus below the brevis; and supply hamstring muscles & anastomose with each other, sciatic, internal circmflex & termination of profunda, the middle one, the largest, giving off ascending & descending branches, and nutrient artery of femur.

POPLITEAL ARTERY

Commences at opening in lower part of adductor magnus.
Downwards & outwards to back of knee-joint, and then vertically downwards to lower border of popliteus muscle, where divides into anterior & posterior tibial.

RELATIONS:

In Front – Inner & posterior surfaces of femur, posterior ligament of knee-joint, popliteus muscle.
Behind – Skin & fascia; quantity of fat & lymphatic glands; semimembranosus; gastrocnemius, plantaris, soleus; popliteal vein, internal popliteal nerve.
On Inner Side – Semimembranosus; inner condyle; inner head of gastrocnemius.
On Outer Side – Biceps; outer condyle; outer head of gastrocnemius, plantaris.
Popliteal vein lies close to artery, and is superficial & external to it except at lower part, where it crosses to inner side; it is frequently double at lower part. – Internal popliteal nerve is more superficial & external above, and is superficial & internal below.

BRANCHES:

MUSCULAR:

Superior — Two or three, small, to hamstring muscles & vasti. Anastomose with perforating & articular arteries.
Inferior or Sural — Two, large, to heads of gastrocnemius & plantaris.

CUTANEOUS: — A few, slender; arise separately or with sural. Over gastrocnemius to integument of back of leg.

ARTICULAR — Five:

Superior – Two. Wind round femur above condyles to front of knee, passing, the
Internal, – Beneath tendon of adductor magnus;
External, – Beneath tendon of biceps; and both dividing into
Superficial & *deep brs.* – to vasti, femur & joint, and anastomosing with each other, and with inferior articular arteries, anastomotica magna & descending branch of external circumflex.

Azygos – Arises behind posterior ligament of knee-joint, which it pierces to supply interarticular ligaments & synovial membrane.

Inferior – Two. Arise beneath gastrocnemius, and wind round head of tibia beneath internal & external lateral ligaments, the external artery passing above head of fibula & beneath tendon of biceps. Divide into numerous branches to front of knee, and anastomose with each other, and with superior articular & the recurrent branch of tibial.

ANTERIOR TIBIAL ARTERY

Anterior & smaller branch of bifurcation of popliteal opposite lower border of popliteus muscle

Forwards between the two heads of tibialis posticus, and between tibia & fibula through opening in upper part of interosseous ligament

Downwards in front of interosseous ligament, shaft of tibia & ankle joint (where becomes dorsalis pedis), passing between tibialis anticus & extensor longus digitorum between tibialis anticus & extensor proprius pollicis, between tendon of extensor proprius pollicis, which crosses it, and innermost tendon of extensor longus digitorum – lying in a line from inner side of head of fibula to midway between malleoli, and being deeply situated, above, between muscles on either side & beneath tendon o extensor proprius pollicis, and superficially, below, beneath skin, anterior annula ligament & fascia

Has two venæ comites. Anterior tibial nerve is first external, then anterior then again external to it

BRANCHES :

Recurrent tibial — Arises in upper part of leg. Upwards through tibialis anticu to front of knee, and anastomoses with inf. articular branches of poplitea

Muscular — Numerous small branches to muscles on either side.

Malleolar — Two; rather variable in size. Arise near ankle, and pass, the

INTERNAL, – To inner ankle beneath tendons of extensor proprius pollicis & tibialis anticus

EXTERNAL, – To outer ankle beneath extensor longus digitorum,

and anastomose respectively with posterior tibial & internal planta and with tarsal & peronea

DORSALIS PEDIS ARTERY

From bend of ankle to back of first interosseous space, resting upon bones of tarsus between tendon of extensor proprius pollicis & innermost tendon of extensor brev digitorum, which crosses it near termination, and having anterior tibial nerve on i outer sid

BRANCHES :

Tarsal — Arches outwards beneath extensor brevis digitorum, and anastomoses wit metatarsal, external malleolar & external planta

Metatarsal — More or less obliquely forwards in front of preceding. Gives off th

THREE OUTER DORSAL INTEROSSEOUS ARTERIES – Along corresponding interosseou spaces. Are joined by anterior & posterior perforating branches, an supply dorsal digital branches to 3½ toes on outer side of foo

Dorsal Art. of Great Toe — Is the first dorsal interosseous artery, and suppli dorsal digital branches to 1½ toes on inner side of foo

Communicating — Between the two heads of first dorsal interosseous muscle, an inosculates with external plantar, completing plantar arch. Gives plantar digital branches to 1½ toes on inner side of foot

POSTERIOR TIBIAL ARTERY

Posterior & larger branch of bifurcation of popliteal opposite lower border of popliteus muscle.

Downwards & inwards upon tibialis posticus, flexor longus digitorum, lower end of tibia & ankle joint, being covered by gastrocnemius, soleus and deep layer of fascia in upper two-thirds, and, in lower third, by integument & fascia only on inner side of tendo Achillis.

Divides into the two plantar arteries midway between internal malleolus & heel, and between tendons of tibialis posticus & flexor longus digitorum, which are anterior & internal to it, and tendon of flexor longus pollicis, which lies posterior & external.

Internal popliteal nerve is first posterior & internal to it, but soon crosses to its outer side.

BRANCHES:

Peroneal — Arises an inch below lower border of popliteus.

Downwards & outwards upon tibialis posticus & flexor longus pollicis & between fibres of latter muscle, and beneath soleus & deep layer of fascia, and ends on outer side of os calcis, joining with external malleolar & external plantar. Gives off branches:

Muscular – To soleus & muscles of deep layer, and peronei.

Nutrient to Fibula – Downwards in nutrient canal towards lower extremity of the bone.

Communicating to Post. Tibial – Inwards beneath flexor tendons a little above ankle joint.

Ant. Peroneal – The largest branch. Through interosseous membrane two inches above malleoli. Downwards beneath peroneus tertius to outer side of tarsus, and joins with external malleolar & tarsal.

Muscular — To soleus & muscles of deep layer.

Nutrient to Tibia — The largest of the nutrient arteries. – Downwards in nutrient canal towards lower extremity of the bone.

Communicating to Peroneal — Outwards beneath flexor tendons a little above ankle joint.

Internal calcanean — To integument & fat about tendo Achillis & heel.

THE PLANTAR ARTERIES

Branches of bifurcation of posterior tibial beneath internal annular ligament & origin of ab ductor pollici

INTERNAL PLANTAR — The smaller.

Forwards between abductor pollicis & flexor brevis digitorum, and ends at extremity first metatarsal bone in a small branch which runs along inner border of gre toe, and joins with the corresponding plantar digital artery from communicatin branch of dorsalis pedi

EXTERNAL PLANTAR — The larger.

Outwards between flexor brevis digitorum & flexor accessorius, and then forwards b tween former muscle & abductor minimi digiti as far as base of 5th metatars bon

Round outer border of flexor accessorius, and inwards upon interossei & bases of th metatarsal bones, –beneath adductor pollicis, flexor tendons & lumbricales,– back of first interosseous space, where inosculates with communicating branc of dorsalis pedis, thus completing plantar arc

BRANCHES:

Posterior perforating — Three – Through back part of three outer interc seous spaces, and inosculate with dorsal interosseous branches fro metatars

Plantar interosseous (Digital) — Four. Forwards upon interosseous spac (outermost crossing under surface of 5th metatarsal bone und cover of abductor & flexor brevis minimi digiti), and supply plant digital branches to 3½ toes on outer side of foot. The three innermo give off t

Ant. Perforating arteries – Three. Through anterior part of thre outer interosseous spaces, and inosculate with the dorsal interc seous branches from metatarsal just before they bifurcate.

THE VEINS.

DESCENDING TRUNKS of FIRST ORDER.

INNOMINATE VEINS — Two large trunks formed by junction of internal jugular & subclavian behind corresponding sterno-clavicular articulation.

RIGHT INNOMINATE — An inch & a half long, somewhat smaller than the left, and nearly vertical. Lies superficial & external to innominate artery, and is separated externally from right lung by right phrenic nerve & pleura. Joins with left innominate just below cartilage of 1st rib to form superior cava. Receives:

Right Lymphatic Duct – At its origin, in angle of junction between right subclavian vein & right internal jugular.

Tributary Branches: – *Right Vertebral, Internal Mammary, Inferior Thyroid, & Superior Intercostal.*

LEFT INNOMINATE — Three inches long, & somewhat larger than the right. Descends obliquely from behind left sterno-clavicular articulation to just below 1st costal cartilage of right side, lying in front of innominate, left common carotid & subclavian arteries, and behind sterno-hyoid & -thyroid muscles, remains of thymus gland, & sternum. Receives

Tributary Branches : *Left Vertebral, Internal Mammary, Inferior Thyroid, Superior Intercostal,* and sometimes some small *Thymic & Pericardiac Veins.* – The innominate veins have no valves.

SUPERIOR VENA CAVA — Short thick trunk (2½ to 3 inches long), slightly curved, & convex to the right. Descends vertically along right side of ascending portion of arch of aorta & in front of root of right lung from just below 1st costal cartilage of right side, enters fibrous bag of pericardium about an inch and a half above the heart, becomes invested anteriorly by serous layer on the same bag, and opens into upper & front part of right auricle; is separated externally from right lung by right phrenic nerve & pleura, and its anterior relations are the same as those of the innominate. – Receives

Tributary Branches; – *Vena Azygos Major,* and some small *Pericardiac & Mediastinal Veins.* – Has no valves.

THEIR TRIBUTARY BRANCHES.

Vertebral – Commences in deep muscles of upper & back part of neck, and then accompanies vertebral artery through foramina in transverse processes of the vertebræ from the atlas to the 6th, and opens into back part of innominate close to its origin, crossing, on the right side, the first part of the subclavian artery; its opening is guarded by a pair of valves. Sometimes double inferiorly, one of its trunks passing through small foramen in transverse process of 7th cervical vertebra. Receives

Tributary Branches: – *Dorsi-Spinal, Meningo-Rachidian, Ascending & Deep Cervical.*

Internal Mammary – Two to each artery. Accompany artery receiving corresponding branches, unite into one trunk at upper part of thorax, and open into front of innominate.

Inferior Thyroid – One on each side, sometimes more. Commence in venous plexus upon thyroid gland, communicating with middle & superior thyroid; descend in front of trachea, communicating with each other by numerous transverse branches, and, inclining outwards beneath sterno-thyroid, open, the left one into middle of left innominate, the right one into termination of right innominate, their opening being guarded by a valve. Receive

Tributary Branches: – *Tracheal & Inferior Laryngeal.*

Superior Intercostal – The right one is smaller than the left, and closely corresponds to its artery. The left one, in addition to corresponding to its artery, receives the intercostal veins from the two, three, or four first spaces, varying in size in correspondence with the increased or diminished size of the left superior azygos; it also receives the left bronchial vein. – These veins are occasionally seen to take a descending course, and to open into the vena azygos major.

Vena Azygos Major – V. Spinal veins, 2nd Tablet.

Thymic –
Pericardiac –
Mediastinal –
} Small, irregular; open, most of them into left innominate or superior cava, some into internal mammary.

VEINS of HEAD & NECK—1st Tablet.

TRUNKS.

ANTERIOR JUGULAR VEIN — Commences in submaxillary region and descends beneath platysma between sterno-mastoid & middle line of neck, and then deeply beneath sterno-mastoid, beneath which muscle it communicates with external & internal jugulars, and usually also with its fellow by a long & narrow transverse branch. Ends usually in subclavian close to external jugular, sometimes in terminal portion of external jugular. Receives

Lateral Tributary Branches: – A few *laryngeal veins* & sometimes an *inferior thyroid vein*. – Varies greatly in size, and is frequently absent on one side or other.

EXTERNAL JUGULAR VEIN — Formed by coalescence of temporal, internal maxillary, & posterior auricular, and commences in substance of parotid gland opposite angle of jaw. Descends perpendicularly over sterno-mastoid & along its posterior border, beneath platysma & over superficial cervical n., and, perforating deep fascia, opens into subclavian externally to internal jugular. Has two pairs of valves situated, one at its opening into subclavian, the other about an inch & a half above clavicle. – Receives

Lateral Tributary Branches : – *Suprascapular*, *Transversalis Colli*, *&* *Posterior External Jugular*, sometimes the *Occipital ;* – and communicates with the anterior & internal jugulars, with the latter by a large branch in substance of parotid.

INTERNAL JUGULAR VEIN – The continuation of lateral sinus opposite jugular foramen, in which foramen it is expanded into the *gulf or sinus of the internal jugular vein*. Descends vertically, lying first on outer side of & a little behind internal carotid, then on outer side of common carotid, and finally, on the left side, on outer side & in front of common carotid, and, on the right side, externally to & at a certain distance from it, in front of first part of subclavian. The eighth & ninth nerves lie on inner side & in front of its sinus; lower down the spinal accessory crosses the vein posteriorly, and the glosso-pharyngeal & hypoglossal pass forwards on its inner side, between it and the internal carotid; the pneumogastric lies along whole of neck between & behind the two vessels; behind the vein are the recti capitis lateralis, anticus major, & the longus colli. – Joins subclavian behind sterno-clavicular articulation to form the innominate, a pair of valves being situated at or a little above its termination. – Receives

Lateral Tributary Branches : – *Occipital* (usually), *Facial, Lingual, Pharyngeal, Superior & Middle Thyroid ;* – and communicates by a large branch with external jugular in substance of parotid.

VEINS of HEAD & NECK—2nd Tablet.

THEIR TRIBUTARY BRANCHES.

TRIBUTARY BRANCHES OF THE EXTERNAL JUGULAR:

Temporal – Commences on side of vertex by anterior & posterior branches, which join respectively with frontal, & with posterior auricular & occipital, and then unite just above zygoma. The trunk receives the *middle temporal & transverse facial,* accompanies its artery through parotid gland, and joins with internal maxillary.

Internal Maxillary – Receives branches corresponding to those of artery, and joins with temporal to form principal origin of external jugular, the temporo-maxillary trunk giving off in substance of parotid a large branch of communication to facial. – The veins corresponding to the branches of the internal maxillary artery form the *pterygoid plexus,* which occupies the space between the temporal & pterygoid muscles, and which communicates with the cavernous sinus & the facial vein.

Posterior Auricular – Commences above and behind ear, communicating with occipital & posterior branch of temporal, receives *stylo-mastoid,* and opens into temporo-maxillary trunk just above origin of external jugular.

Occipital – Vide below.

Posterior External Jugular – Lies between trapezius & splenius, and returns the blood from integument & superficial muscles of upper & back part of neck. Opens into external jugular just below middle of its course.

TRIBUTARY BRANCHES OF THE INTERNAL JUGULAR:

Occipital – Commences at back of vertex, accompanies its artery, receives *mastoid* vein, and opens into upper part of internal jugular, or sometimes into the external jugular. – The mastoid vein establishes a communication between it & the lateral sinus.

Facial – The continuation of angular vein opposite inner canthus. Downwards & outwards behind facial artery, taking a similar but less tortuous course beneath zygomatici and over levatores labii superioris & anguli oris & buccinator; crosses lower jaw in front of masseter; and, descending over stylo-hyoid & posterior belly of digastric & beneath platysma, opens into the internal jugular. Receives *Supraorbital* & *frontal* (forming together the *angular*), *palpebral, infra-orbital, superior & inferior labial, buccal, masseteric, submental, inferior palatine, sub-maxillary, & ranine,* and a large branch of communication from temporo-maxillary trunk; communicates freely with ophthalmic vein & pterygoid plexus.

Lingual – Commences on dorsum, side, & under surface of tongue, follows artery and opens into internal jugular.

Pharyngeal – Commences in a minute plexus at back & side of pharynx, receives meningeal, vidian, & spheno-palatine veins, and opens, usually into the internal jugular, sometimes into the facial, lingual, or inferior thyroid.

Superior Thyroid – Commences in substance & on surface of thyroid gland, accompanies its artery, receiving the *superior laryngeal,* and opens into the internal jugular below the lingual.

Middle Thyroid – Commences in lower part of lateral lobe of thyroid gland, receives a few small branches from larynx & trachea, crosses common carotid beneath sterno-mastoid, and opens into lower part of internal jugular. – Before opening into the internal jugular, the facial, lingual & superior thyroid veins often join into a plexus in front of upper part of common carotid.

The *vertebral vein* has already been described.

CEREBRAL & CEREBELLAR VS. & VS. of the DIPLOË

CEREBRAL VEINS — Have very thin coats devoid of muscular tissue, and no valv
They may be divided into superficial & de

SUPERFICIAL — Mainly lodged in the sulci. They receive branches from the su
stance of the brain, and open into the sinuses of the dura mater. They are divid
int

Superior - Seven or eight on each side. Pass forwards & inwards to longitudin
fissure, where they receive the internal cerebral veins from inner surface
hemispheres, become invested by a tubular sheath from the arachno
and open into the superior longitudinal sinuses, most of them towards
posterior part, and most of them from behind forwar

Internal - Collect the blood from the inner flat surface of hemispheres, and ascend
join the foregoing to open into the superior longitudinal sin

Anterior Inferior - Collect the blood from under surface of frontal lobe, and op
into cavernous sin

Inferior Lateral - Collect the blood from under surface of temporo-sphenoidal lob
and open into the lateral & superior petrosal sinuse

Inferior Median - Collect the blood from interpeduncular space & from under su
face of occipital lobe, and open into the straight sinus behind the venæ Gale

DEEP — Are two terminal trunks, the venæ Galeni, formed by junction behind anteri
pillars of fornix of the choroid vein with the vena corporis stria

Choroid Vein - Runs forwards & inwards in choroid plexus along outer margin
velum interpositum, receiving branches from hippocampus major, fornix,
corpus callosum, and joins with the vena corporis striati behind anteri
pillar of forn

Vena Corporis Striati - Commences in groove between corpus striatum & op
thalamus, receiving numerous branches from both these parts, and joins wi
the choroid vein behind anterior pillar of forn

Vena Galeni - Backwards along middle line of velum interpositum; through tra
verse fissure between tubercula quadrigemina & posterior extremity
splenium of corpus callosum; and opens into anterior extremity of straig
sinus. Receives a few of the superior cerebellar vei

CEREBELLAR VEINS — Occupy the surface of the organ, and are divided into:

Superior - Pass forwards & inwards over hemispheres & superior vermiform proce
and open, most of them into the straight sinus, some of them into the ve
Gale

Inferior - Pass outwards, and open most of them into the lateral sinuses, some i
the superior petrosal sinus

VEINS of the DIPLOË — Are seen, when the outer table of the skull is removed
means of the file, to form an irregular network of venous canals hollowed out in t
substance of the bones, and lined by a thin stratum of elastic tissue & a layer
squamous epithelium. They present a few pouch-like dilatations or culs-de-sac, a
are most developed in the aged. In early life, and as long as the cranial bones
ununited, each bone has its separate set of veins, but when the sutures have beco
ossified, the veins of one bone communicate with those of the adjoining ones.
veins of the diploë may then be divided into four sets, as follows (Bresche

Frontal - Descend in central part of frontal bone, and open into the supraorbital v
by an aperture in the supraorbital not

Anterior Temporal - Descend in lateral portion of frontal bone & in great wing
sphenoid, and open into one of the deep temporal vei

Posterior Temporal - Descend in parietal bone, and, at its posterior inferior ang
open into the lateral sin

Occipital - Descend in occipital bone, and open, either into the occipital vein, or i
the occipital sin

The veins of the diploë have numerous communications with the mening
veins & sinuses of the dura mater, and with the veins of the pericrani

SINUSES of the DURA MATER.

Venous canals fifteen in number, and more or less triangular in shape, the outer coat of which is formed by the splitting of the dura mater, while their inner coat is a continuation of the inner or serous coat of the veins. They are divided into:

POSTERO-SUPERIOR GROUP: – *Superior Longitudinal, Inferior Longitudinal, Straight, Lateral, & Occipital,* all converging towards the *Torcular Herophili.*

ANTERO-INFERIOR GROUP: – *Cavernous, Circular, Transverse, Superior & Inferior Petrosal,* all converging towards the sella turcica.

Superior Longitudinal Sinus – Commences at foramen cœcum, through which it frequently communicates by a minute branch with veins of Schneiderian membrane of nose. Runs backwards in attached margin of falx cerebri, grooving middle line of frontal, adjacent borders of parietals & superior division of crucial ridge of occipital, and opens into torcular Herophili. Numerous fibrous bands the *chordæ Willisii,* cross inferior angle of its cavity, and the *glandulæ* Pacchionii project into its base. It receives the superficial veins of upper part of hemispheres, numerous veins from diploë & dura mater, and, at posterior extremity of sagittal suture, the parietal veins from the pericranium.

Inferior Longitudinal Sinus – Sometimes called a vein on account of its cylindrical form. Follows posterior part of free margin of falx cerebri, and opens into anterior extremity of straight sinus behind the venæ Galeni. It receives several small veins from the falx, and accasionally a few from inner surface of hemispheres.

Straight Sinus – Runs downwards & backwards in line of junction of falx cerebri with tentorium cerebelli, and opens into torcular Herophili. Receives venæ Galeni, inferior longitudinal sinus, inferior median cerebral, & superior cerebellar veins. A few fibrous bands cross its superior angle.

Occipital Sinuses – Usually two, small, contained in attached margin of falx cerebelli. Arise near posterior border of foramen magnum in several small veins which communicate with posterior longitudinal spinal veins. They pass backwards & upwards, and open separately or together into torcular Herophili.

Lateral Sinuses – Two, large. Commence at torcular Herophili; pass outwards in posterior attached margin of tentorium cerebelli as far as base of petrous portion of temporal bone, grooving occipital & posterior inferior angles of parietals; curve downwards & inwards grooving mastoid portion of temporals and again the occipital at its lateral angles; and are continued into the internal jugular vein through posterior outer or larger part of foramen lacerum posterius. – They receive the inferior cerebral & inferior cerebellar veins & some veins from the diploë, they are connected to the cavernous sinus by the superior & inferior petrosal sinuses, and they communicate through the mastoid foramen with the mastoid & posterior condyloid veins of the pericranium. The right one is generally somewhat the larger of the two.

Torcular Herophili – An irregular expansion of the postero-superior group of sinuses pretty nearly corresponding in situation to the external occipital protuberance, and formed by the coalescence of the superior longitudinal, straight & occipital sinuses, which pour their blood into it, and of the lateral sinuses, which convey the blood from the torcular to the internal jugular veins.

Cavernous Sinuses – Two large but short sinuses, extending on either side of sella turcica from sphenoidal fissure to apex of petrous portion of temporal bone, and communicating with each other through circular & transverse sinuses, and with the lateral sinuses through the superior & inferior petrosal. Their cavity is intersected by numerous fibrous bands & small vessels; hence their name. Against their inner wall, separated from the blood by the lining membrane of the sinus, are the cavernous portion of the internal carotid artery, the 6th nerve, & the carotid & cavernous plexuses of the sympathetic; in their outer wall lie from above downwards & from within outwards the 3rd, 4th, & ophthalmic nerves. They receive the ophthalmic & anterior inferior cerebral veins.

Circular Sinus – Placed superficially in ring of dura mater which surrounds pituitary body. Receives small veins from this body, adjacent bone, & dura mater, and communicates on either side with the cavernous sinus. Its posterior half is generally larger than the anterior.

Transverse Sinus – Small & short. Crosses fore part of basilar groove, connecting cavernous & inferior petrosal sinuses of one side to those of the other; is sometimes double.

Superior Petrosal Sinus – Small, along upper border of petrous portion of temporal bone in anterior attached margin of tentorium, connecting lateral & cavernous sinuses of same side. Receives inferior cerebellar & inferior lateral cerebral veins.

Inferior Petrosal Sinus – Somewhat larger than foregoing. Along groove in petro-occipital suture, connecting cavernous sinus to termination of the lateral in jugular foramen.

VEINS of UPPER LIMB—1st Tablet.

SUPERFICIAL VEINS — Are:

Radial, *Ant. & Post. Ulnar,*
Median,
Median Cephalic, *Median Basilic,*
Cephalic, *Basilic.*

Radial – Commences at outer side of arch on dorsum of hand. Receives branches from back of thumb & index finger, ascends along front of outer side of fore-arm, communicating with median, and joins at bend of elbow with median cephalic to form the cephalic.

Anterior Ulnar – Commences on anterior aspect of wrist & inner side of palm of hand, ascends along front of inner side of fore-arm communicating with posterior ulnar & median, and, at bend of elbow, joins with posterior ulnar, & then with median basilic, to form the basilic.

Posterior Ulnar – Commences at inner side of arch on dorsum of hand, receiving vena salvatella from little finger, ascends along back of inner side of forearm, and, at bend of elbow, joins with anterior ulnar, & then with median basilic, to form the basilic.

Median – Commences in superficial structures of palm of hand, ascends along middle of front of fore-arm communicating with radial & anterior ulnar, and, after receiving a large branch from venæ comites of brachial, divides at bend of elbow into median cephalic & median basilic.

Median Cephalic – Usually the smaller. Ascends in groove between biceps & supinator longus, lying mainly in front of branches of anterior division of external cutaneous nerve, and joins with radial vein to form the cephalic.

Median Basilic – Usually the larger. Ascends in groove between biceps & pronator radii teres, being more or less surrounded by branches of anterior division of internal cutaneous nerve, and lying in front of brachial artery, from which it is separated by bicipital or semilunar fascia.

Cephalic – Somewhat smaller than basilic. Ascends in groove along outer border of biceps and then in interspace between pectoralis major & deltoid, in which latter situation it is accompanied by humeral or descending branch of acromio-thoracic artery, and ends in axillary vein between coracoid process & clavicle, its opening being guarded by a pair of valves. It communicates sometimes with external jugular or subclavian by a small branch which ascends in front of clavicle.

Basilic – Somewhat larger than cephalic. Ascends in groove along inner border of biceps, pierces deep fascia with internal cutaneous nerve a little below middle of arm, and ends in one of the brachial veins or in the axillary.

N.—Numerous varieties are observed in the disposition of the veins of the bend of the elbow: the median vein with both its terminal branches may be entirely wanting, or, the vein itself being wanting, its two terminal branches may be supplied either by the radial or the anterior ulnar.

EINS of UPPER LIMB—2nd Tablet.

DEEP VEINS

Accompany the arteries, the vena comites being two in number to each artery, except in the case of axillary & subclavian. Thus there are veins:—

Two Digital. Superficial Palmar, Ulnar;
„ *Deep Palmar, Radial;*
„ *Anterior & Posterior Interosseous;*
„ *Brachial;*—the interosseous veins opening into the ulnar.

AXILLARY VEIN — Commences at lower part of axilla as a continuation of the brachials & median basilic. Ascends on inner side of 3rd & 2nd parts of axillary artery, and on inner side & somewhat in front of 1st part, increasing greatly in size by receiving both the branches corresponding to those of the artery, and, near its termination, the cephalic. Is continued into subclavian opposite outer border of 1st rib. Is provided with a pair of valves opposite lower border of subscapularis.

SUBCLAVIAN VEIN — From outer border of 1st rib to behind sterno-clavicular articulation, where it joins with internal jugular to form the innominate. It lies in succession;

Below, in front, & to inner side of 3rd part of artery, resting upon pleura;
Below & in front of 2nd part, grooving upper surface of 1st rib in front of tubercle for scalenus anticus, and being separated from artery by scalenus anticus & phrenic nerve; – this portion of the vein sometimes rises in the root of the neck as high as the artery.
In front of 1st part of the artery behind inner extremity of clavicle, lying below the artery on the right side, crossing it on the left.

It receives, externally to the scalenus, the external & anterior jugular veins, and sometimes a small branch from the cephalic. It is usually provided with valves about an inch from its termination in the innominate.

ASCENDING TRUNKS of FIRST ORDER.

COMMON ILIAC VEINS — Formed by junction of external & internal iliacs posite sacro-vertebral articulation (some authors say opposite sacro-iliac synci drosis). Obliquely upwards, the left one more obliquely than the right, to a lit to the right side of intervertebral disc between 4th & 5th lumbar vertebræ, wher ney unite to form the inferior va.

RIGHT COMMON ILIAC — Shorter & less oblique than the left one ; lies irst behind & then on outer side of its artery. Re ves

Tributary Branches: – *Ilio-Lumbar*, & sometimes *Lateral Sacral.*

LEFT COMMON ILIAC — Longer & more oblique than the right one; lies irst on inner side of its artery, and then passes behind artery o ght side. Re ves

Tributary Branches: – *Ilio-Lumbar*, & sometimes the *Lateral &* *ddle Sacral.* – The common iliac veins have no ves.

INFERIOR VENA CAVA — Formed by junction of the two common iliacs a ttle to the right side of intervertebral disc between 4th & 5th lumbar ver ræ.

Along right side of aorta in front of right lumbar & renal arteries & right crus c lia-phragm, passing in succession behind attached border of mesentery, transvers or-tion of duodenum, pancreas, & portal nk.

Through groove or canal in posterior border of liver, where the hepatic veins open it.

Perforates central or cordiform tendon of diaphragm between its middle & right le ets.

Enters fibrous bag of pericardium, becomes invested anteriorly by serous layer of me sac, and opens into lower & back part of right auricle near interauricular se m, its opening being guarded by the Eustachian valve. Re ves

Tributary Branches: – *Middle Sacral*, *Lumbar*, *Renal*, *Hepatic*, *Righ ter-matic*, *Suprarenal*, *&* *Inferior Phrenic*, the middle sacral som nes **opening into the left common ac.**

THEIR TRIBUTARY BRANCHES.

Ilio-Lumbar – Open into common iliac.

Lateral Sacral – Open either into common or into internal iliac.

Middle Sacral – Open into left common iliac or inferior cava.

Lumbar – Three or four on each side. Correspond to the lumbar arteries, and collect the blood by dorsal branches from the muscles & integument of the back, and by abdominal branches from the walls of the abdomen. Round sides of bodies of vertebræ beneath psoas, receiving branches from the spinal plexuses, and open into back part of vena cava; the left lumbar veins pass beneath the aorta, and are longer than the right ones. The two or three highest usually join into a plexus, from which arises an ascending trunk, the *ascending lumbar vein*, which forms the most frequent origin of the corresponding vena azygos.

Spermatic – Ascend along front of spermatic cord, forming a branched & convoluted plexus, the *plexus pampiniformis;* enter abdomen and coalesce into two branches which run up upon psoas on either side of spermatic artery, the vessels of the left side passing beneath the sigmoid flexure of the colon; and open by a common trunk, on the right side into the inferior cava, on the left side into the left renal. – The *ovarian veins* of the female form their pampiniform plexus within the broad ligament of the uterus, and communicate freely with the uterine; their subsequent course is the same as that of the spermatic veins in the male. – Valves are found in the spermatic veins, and occasionally also in the ovarian.

Renal – Large, short; lie in front of artery. The left vein is the longest, and usually opens into the inferior vena cava a little lower than the right one; it crosses aorta below origin of superior mesenteric artery, and receives the left spermatic, suprarenal, & inferior phrenic.

Suprarenal – Open on right side into inferior cava, on left side into renal.

Inferior Phrenic – Open on right side into inferior cava, on left side into renal.

Hepatic – Communicate within lobules of liver with lobular branches of portal vein, and also indirectly with terminal branches of hepatic artery (Kiernan), and form in succession the intralobular & sublobular veins, and the hepatic veins proper (V. Structure of the Liver). These latter form three trunks destitute of valves, and open into the inferior cava whilst that vessel is contained in the groove in posterior border of liver.

VEINS of LOWER LIMB—1st Tablet.

SUPERFICIAL VEINS.

EXTERNAL or SHORT SAPHENOUS — The smaller; commences at ou side of arch on dorsum of foot. Accompanies external or short sapheno nerve behind outer malleolus, along outer border of, & over, tendo Achill and between the two heads of gastrocnemius; it then perforates deep fasc at lower part of popliteal space, and opens into the popliteal. It receiv numerous branches from back of leg, and communicates with deep veins dorsum of foot & behind external malleolus. It is provided with two valv one of which is always found near its terminatio

INTERNAL or LONG SAPHENOUS — The larger; commences at inn side of arch on dorsum of foot. Accompanies long or internal saphenous ner in front of internal malleolus, along inner side of leg, & behind inner condyl it then inclines forwards along inner aspect of thigh, and, passing throug saphenous opening, terminates in the femoral about an inch & a half belo Poupart's ligament. It receives numerous cutaneous branches from leg thigh, (the branches from inner aspect of thigh frequently uniting into o large trunk); and it also receives near its termination, the superficial epiga tric, superficial circumflex iliac & superficial external pudic. It commun cates with the internal plantar, anterior & posterior tibial, & femoral, a contains from two to six valves, which valves are usually more numerous the thigh than in the le

EINS of LOWER LIMB—2nd Tablet.

DEEP VEINS.

Accompany the arteries, the venæ comites being two in number for each artery, except in the case of the popliteal, femoral, & external iliac. Thus there are veins:—

Two External, & Internal Plantar, Posterior Tibial, & Peroneal;
„ *Dorsalis Pedis, & Anterior Tibial.*

POPLITEAL VEIN — Formed by junction of venæ comites of anterior & posterior tibial. Is first superficial & internal to the artery, and then superficial & external to it. Receives the external or short saphenous vein in addition to the veins corresponding to the branches of the popliteal artery. Its valves are usually four in number.

FEMORAL VEIN — Posterior & external to the artery in Hunter's canal, but gets progressively to its inner side by time it reaches Poupart's ligament. Receives the long or internal saphenous vein, and the branches corresponding to those of the femoral artery, except the superficial epigastric, superficial circumflex iliac, & superficial external pudic, which latter branches open into the internal saphenous. Has usually four or five valves.

EXTERNAL ILIAC VEIN — Vein of left side lies altogether on inner side of its artery; vein of right side is first internal to its artery, & then posterior to it. – Receives epigastric & circumflex iliac veins, and joins with internal iliac opposite sacro-iliac synchondrosis to form the common iliac. Has no valves.

VEINS of the PELVIS.

Are the internal iliacs and their branches, which branches correspond to the branches the internal iliac arteries, the umbilical arteries except

INTERNAL ILIAC VEIN — Is internal & posterior to its artery, except superiorly & on right side, where it becomes posterior to it. Joins with external iliac oppo sacro-iliac synchondrosis to form common iliac. – Receiv

Visceral Branches – Form plexuses remarkable for their large size, their frequent a stomoses, & the number of valves they contain. These plexuses are t

Hæmorrhoidal – Surrounds lower end of rectum, and forms an import communication between general & portal systems of veins, for fror arise the superior, middle, & inferior hæmorrhoidal veins, which o respectively into inferior mesenteric, internal iliac, & pu

Vesico-Prostatic – Surrounds neck & base of bladder & prostate gland, increases greatly in size as age advances. It communicates posteri with hæmorrhoidal plexus, and receives anteriorly the dorsal vei the penis. – This vein runs along groove on dorsum of penis receiv veins of glans & of corpus spongiosum and numerous superfi veins, and unites with its fellow near root of penis to form one tr which trunk perforates triangular ligament beneath pubic arch, divides into two branches which open into the vesico-prostatic plexu

Uterine – Situated along sides & superior angles of uterus between la of broad ligament. Receives the large veins of uterus (uterine sinu and communicates freely with the pampiniform plexus of the ova ve

Vaginal – Surrounds mucous membrane & erectile structures at orific vagina, and communicates with the vesical & hæmorrhoi

Non-Visceral Branches (Obturator, Sciatic, Pudic, Ilio-Lumbar, Lateral Sac Gluteal) – Follow course of corresponding arteries, and do not req any special no

SPINAL VEINS.

May be divided into extra-spinal or dorsi-spinal veins, and into intra-spinal veins or veins of the cord & its membranes.

EXTRA-SPINAL or DORSI-SPINAL VEINS — Form a dense & complicated network which surrounds the laminæ & the spinous, transverse, & articular processes of the vertebræ from the atlas to the coccyx. Posteriorly they receive small branches from the muscles & integument behind the spine, and communicate with the intraspinal veins by branches which perforate the ligamenta subflava. Anteriorly, after again communicating with the intraspinal veins through the intervertebral foramina, they open into the vertebral veins, in the neck, the intercostal veins, in the back, and the lumbar & sacral veins, in the loins & pelvis.

INTRA-SPINAL VEINS — May be divided into anterior longitudinal, posterior longitudinal, & meningo-rachidian. – They are not provided with valves.

Anterior Longitudinal – Two large irregular tortuous trunks most developed in the dorsal & lumbar regions, which descend over back of bodies of vertebræ along whole length of spine on either side of posterior common ligament. They communicate with each other opposite each vertebra by a transverse branch, which passes beneath the common ligament and receives the venæ basis vertebræ. Opposite the intervertebral foramina, they communicate with the dorsi-spinal veins, and also with the vertebrals, in the neck, the intercostals, in the back, and the lumbar & sacral veins, in the loins & pelvis.

The *venæ basis vertebrarum*, or veins of the bodies of the vertebræ, are contained in large tortuous canals very similar to those found in the diploë of the bones of the skull. They arise from the whole of the periphery of the bodies, where they communicate with the small veins which enter through the foramina on the anterior surface, and, passing horizontally backwards, they converge towards one or two principal trunks which open into the branches of communication between the anterior longitudinal veins

Posterior Longitudinal – Somewhat smaller than foregoing, but equally tortuous. Descend along anterior aspect of laminæ, communicating with each other, the anterior longitudinal, & the dorsi-spinal.

Meningo-Rachidian – Emerge from the cord chiefly along its postero-median fissure, and form a minute plexus which surrounds the whole of the cord between the pia mater & the arachnoid. Near the base of the skull they unite into two or three small trunks, which communicate with the vertebral veins, and open into the inferior cerebellar. They join with the other veins of the spinal canal through branches which accompany the spinal nerves as far as the intervertebral foramina.

THE VENÆ AZYGOS.

Collect the blood from the intercostal spaces, and are three in number, the major, mi &
left sup r.

VENA AZYGOS MAJOR, or RIGHT AZYGOS — Commences in the rig s.
cending lumbar vein, or sometimes in a branch from the inferior cava o e
right l.
Through aortic opening of diaphragm on right side of thoracic duct, behind n
right side of aorta; – sometimes through right s.
Along right side of spine in front of right intercostal arteries to 3rd dorsal vert a.
Arches forwards over root of right lung, and opens into superior vena cav st
before it enters pericardium. Rec s:
Tributary Branches : – *Nine or ten lower intercostal veins of right side, vena os*
minor, several small œsophageal, mediastinal & spinal veins, the right bro l,
sometimes the *right superior intercostal,* and occasionally the *le* *u.*

VENA AZYGOS MINOR, or LEFT LOWER AZYGOS — Arises in left as d.
ing lumbar vein, or sometimes in a branch from left l.
Perforates left crus of diaphragm (passes sometimes through aortic opening) d
ascends along left side of spine in front of left intercostal arteries to 6th h
dorsal vert a.
Crosses spine behind aorta & thoracic duct, and opens into vena azygos r.
Rec s:
Tributary Branches: – *Four or five lower intercostal veins of left side, several ll*
mediastinal, œsophageal & spinal s.

LEFT UPPER AZYGOS — Receives the blood from those left intercostal veins, u ly
two or three in number, which are situated between the intercostal veins t
open into the left lower azygos and those that open into the left superior r-
costal. It therefore varies greatly in size, diminishing as these latter vei -
crease, & *vice versa ;* often it does not exist at all, or one or more of the 5th h,
& 7th left intercosal veins may merely open directly into the vena azygos r.
When there is a distinct left upper azygos, it opens either into the azygos r,
or into the left lower azygos. – A few imperfect valves are found in the in
azygos vein; distinct valves are found in the intercostal s.

ORTAL SYSTEM.

PORTAL TRUNK — Formed by junction of splenic & superior mesenteric veins behind upper border of head of pancreas.

Upwards & to the right in right or free border of lesser or gastro-hepatic omentum, lying between & behind hepatic artery & bile duct, in front of foramen of Winslow. Expands near right extremity of transverse fissure of liver into the *sinus of the portal vein,* and divides into right branch, the larger & shorter, and left branch, the smaller & longer; which branches ramify in portal canals with branches of hepatic artery, bile ducts, deep lymphatics, & nerves. (For distribution of portal vein in the liver and its continuation into the hepatic veins, vide Structure of Liver). – Receives veins:

Gastric & Cystic – The former runs from cardia to pylorus; the latter frequently opens into right branch of portal vein.

Splenic Vein – Arises by five or six branches of considerable size, which emerge from hilum of spleen and join to form one large trunk, which trunk takes a straight course from left to right behind upper border of pancreas, below splenic artery, and, at upper border of right extremity or head of pancreas, joins with superior mesenteric to form the portal trunk. Receives veins: *Inferior Mesenteric* (Vide below), *Vasa Brevia*, *Left Gastro-Epiploic*, *Pancreatic & Pancreatico-Duodenal.*

Superior Mesenteric Vein – Arises from area of distribution of superior mesenteric artery, (small intestine, cœcum, ascending portion & right half of transverse portion of colon), its branches corresponding to those of the artery. Its trunk lies to the right & a little in front of the artery, and passes with it in front of transverse portion of duodenum & behind pancreas, and, at upper border of head of pancreas, joins with splenic vein to form the portal trunk.

Inferior Mesenteric Vein – Arises from area of distribution of inferior mesenteric artery (upper part of rectum, sigmoid flexure, descending portion & left half of transverse portion of colon), – its superior hæmorrhoidal branch anastomosing with the middle & inferior hæmorrhoidal branches of the internal iliac & pudic, and thus establishing an important communication between the portal & general venous systems, which communication is supplemented, according to Kiernan, by communications between the right renal vein & the veins of the ascending colon & duodenum, and by communications in the coronary ligament of the liver between the phrenic & the superficial branches of the portal vein. Ascends beneath peritoneum and behind transverse portion of duodenum & pancreas, and opens into splenic.

The portal system contains no valves.

THE MAIN TRUNKS AND THEIR TRIBUTARIES.

EXTERNAL JUGULAR.
- TEMPORAL, INTERNAL MAXILLARY, & POSTERIOR AURICULAR,
- SUPRASCAPULAR,
- TRANSVERSALIS COLLI,
- POSTERIOR EXTERNAL JUGULAR,
- OCCIPITAL (Sometimes).

INTERNAL JUGULAR.
- OCCIPITAL (Usually).
- FACIAL,
- LINGUAL,
- PHARYNGEAL,
- SUPERIOR THYROID,
- INFERIOR THYROID.

RIGHT INNOMINATE.
- RIGHT LYMPHATIC DUCT,
- VERTEBRAL,
- INTERNAL MAMMARY,
- INFERIOR THYROID,
- SUPERIOR INTERCOSTAL.

LEFT INNOMINATE.
- THORACIC DUCT,
- VERTEBRAL,
- INTERNAL MAMMARY,
- INFERIOR THYROID,
- SUPERIOR INTERCOSTAL,
- THYMIC & PERICARDIAC (Sometimes).

SUPERIOR CAVA.
- VENA AZYGOS MAJOR,
- PERICARDIAC.
- MEDIASTINAL.

RIGHT COMMON ILIAC.
- ILIO-LUMBAR,
- LATERAL SACRAL (Sometimes*).

LEFT COMMON ILIAC.
- ILIO-LUMBAR,
- LATERAL SACRAL (Sometimes*),
- MIDDLE SACRAL (Usually).

INFERIOR CAVA.
- MIDDLE SACRAL (Sometimes),
- LUMBAR,
- RENAL,
- HEPATIC,
- RIGHT SPERMATIC,
- RIGHT SUPRARENAL,
- INFERIOR PHRENIC.

* At other times these veins open into the internal iliacs.

THE LYMPHATICS.

THE THORACIC & RIGHT LYMPHATIC DUCTS.

THORACIC DUCT — Commences in receptaculum chyli, passes through aortic opening o diaphragm, and then ascends in front of spine as high as 4th dorsal vertebra, lyin behind œsophagus, between aorta & vena azygos major. It then inclines to the left and ascends first behind arch of aorta and then behind first portion of subclavia artery of left side; and finally, opposite upper border of 7th cervical vertebra, it arche forwards above pleura & in front of scalenus anticus, and opens into angle of junctio between left internal jugular & subclavian veins, its opening being guarded by a pai of valves. It is somewhat tortuous in its course, constricted at intervals on accoun of the valves it contains; of the size of a goose-quill at its commencement, somewha narrower in the thorax, again enlarged at the root of the neck. Sometime it bifurcates, its left division taking the usual course, its right division joinin the right lymphatic duct. – It is the common trunk of all the lymphatics of the body except those of the right side of the head, neck, & thorax, right upper limb, righ lung, right side of the heart, & part of the convex surface of the liver

Receptaculum Chyli – Is a dilatation of the commencement of the thoracic duct which lies in front of the 2nd lumbar vertebra, behind & to right side of th aorta, and between it and the vena azygos major & the right crus of th diaphragm. It receives the trunks of the lacteal vessels, and four or fiv large trunks from the lumbar lymphatic gland

RIGHT LYMPHATIC DUCT — Is a short thick trunk from half an inch to an inch i length and of about a line or a line & a half in diameter, which collects the lymp from the right side of the head, neck, & thorax, right upper limb, right lung, righ side of the heart, & part of the convex surface of the liver. It opens into the angl of junction between the right internal jugular & right subclavian veins, its openin being guarded by a pair of valve

LYMPHATICS of the HEAD & NECK.

VESSELS — Are superficial & deep.

Superficial Vessels

Of the Cranium – Divided into:

Frontal – Accompany frontal artery to inner canthus.

Temporal – Accompany anterior & posterior divisions and trunk of temporal artery, pass through parotid glands, and open into deep glands of neck.

Posterior Auricular – Accompany posterior auricular artery to glands near upper end of sterno-mastoid.

Occipital – Accompany occipital artery & its branches to glands at back of head.

Of the Face – Converge from inner canthus, nose, eyelids, & lips, some of them passing through glands on surface of buccinator, and open into submaxillary glands beneath angle & body of jaw.

Of the Neck – Cross sterno-mastoid towards glands along its posterior border; some pass beneath the muscle and open into deep glands of neck.

Deep Vessels

Of the Cranium – Divided into:

Meningeal – Accompany meningeal vessels through foramina at base of skull, and open into deep cervical glands.

Cerebral – Lie between arachnoid & pia mater, and in choroid plexuses of lateral & 3rd ventricles; accompany carotid & vertebral arteries through foramina in base of skull, and open into deep glands of neck.

Of the Face – The lymphatics of the muscles of the face, and those of the mucous membrane of the mouth, nose, & pharynx, and of the cavity of the eyeball, converge towards the parotid, submaxillary, & deep cervical glands.

Of the Neck – All converge towards the chain of glands which accompany the carotid vessels. – At the lower part of the neck, after receiving the superficial lymphatics, & some of the lymphatics from the thorax, they unite into a single trunk, which opens on the left side into the thoracic duct, on the right side into the right lymphatic duct.

GLANDS — Are superficial & deep.

Superficial Glands – Are the *occipital & posterior auricular*, which lie at the back of the head & behind the ear, and receive the occipital & posterior auricular lymphatics; the *superficial parotid*, which receive part of the temporal vessels; the *buccal*, which lie on the surface of the buccinator in the course of the facial lymphatics; the *submaxillary*, which lie beneath the angle & the body of the jaw and receive all the superficial & many of the deep lymphatics of the face, and some of the efferent lymphatics from the posterior auricular glands; and finally the *superficial cervical*, which lie in the course of the external jugular vein & along lower part of posterior border of sterno-mastoid, where they communicate with the axillary glands; they receive the superficial lymphatics of the neck & most of the efferent vessels of the occipital & posterior auricular glands.

Deep Glands – Are the *deep parotid* glands, which lie in the substance of the parotid, and the chain of *deep cervical* glands, which accompany the carotid vessels.

LYMPHATICS of the THORAX.

PARIETAL LYMPHATICS — Are superficial & deep.

Superficial – Pass from within outwards over the pectoralis major, in front, over t trapezius & latissimus dorsi, behind, and converge towards the axillary glan The lymphatics from the mamma pass through a chain of small glands along lo border of pectoralis major, which glands communicate superiorly with the axilla

Deep – Are the intercostals, internal mammary & diaphragmatic vessels, with the c responding and the anterior & posterior mediastinal glands.

The *intercostal lymphatics* accompany the intercostal vessels, receiving the ly phatics from the intercostal muscles & pleura, and from the spinal canal & muscles behind the spine, and, after passing through the intercostal glands, t open into the thoracic duct. The *intercostal glands* are small, variable in numb and situated, most of them, beneath the pleura near the costo-vertebral artic tions, some between the two planes of intercostal muscles.

The *internal mammary lymphatics* arise in the epigastric portion of the abdo nal parieties. They accompany the superior epigastric vessels, ascend betw the anterior fibres of the diaphragm, and accompany the internal mammary vess , communicating with the intercostal lymphatics and passing through the inte mammary glands; they then open, on the left side, into the thoracic duct, on right side into, the right lymphatic duct. The *internal mammary glands* are sm , variable in number, and situated at the anterior extremity of each intercostal sp by side of the internal mammary vessels.

The *diaphragmatic lymphatics* follow the course of the phrenic vessels, and o , some into the anterior mediastinal & internal mammary glands, some into intercostal & posterior mediastinal glands.

The *anterior mediastinal glands* lie, some of them upon the diaphragm in f t of the pericardium, others round the large vessels at the base of the heart; y communicate with the internal mammary glands, and receive many of the l phatics of the diaphragm & of the convex surface of the liver.

The *posterior mediastinal glands* form a continuous chain by the side of the a & œsophagus; they communicate with the intercostal, lumbar, & deep cerv l glands, and receive the lymphatics from the œsophagus & surrounding structur

VISCERAL LYMPHATICS — Belong to the

Lungs & Bronchi – The lymphatics of the lung are superficial & deep. The for r arise in a minute plexus beneath the pleura; the latter accompany the blood-ves s & bronchi. They all converge towards the bronchial glands. The *bronchial gl* lie, the larger ones, round the bifurcation of the trachea & the bronchi, the sma r ones, in the root of the lung, and round the larger bronchial tubes to some dist e within the substance of the organ. Their colour darkens as age advances, and y are dark brown in the adult, black in the aged. Their efferent vessels trav e the tracheal, œsophageal & posterior mediastinal glands, and open into e thoracic duct on the left side, into the right lymphatic duct on the right e.

Heart – The lymphatics of the heart arise, the superficial ones, beneath the pericard , the deep ones beneath the endocardium. They converge towards two diffe t trunks. The trunk from the right side of the heart crosses the root of the a , ascends along the right side of the trachea and opens into the right lymphatic d ; the trunk from the left side ascends along the pulmonary artery, and, after pas g through some of the mediastinal glands, opens into the thoracic duct.

Œsophagus – The lymphatics of the œsophagus traverse the posterior medias l glands, communicate with those of the lung, and open into the thoracic t.

Thymus Gland – The lymphatics of the thymus gland arise from its posterior as t, and open separately into the internal jugular veins.

YMPHATICS of the UPPER LIMB.

VESSELS.

Superficial – Arise from skin of hand. Run along sides of fingers, chiefly on dorsal aspect, and ascend along forearm dividing into:

Inner Set – The more numerous. Accompany ulnar veins, and, at bend of elbow receive greater part of following set and open into superficial glands, when such glands exist; they then accompany basilic vein and open into axillary glands.

Outer Set – The less numerous. Accompany radial vein to bend of elbow, where greater part join foregoing; the rest accompany cephalic vein, some crossing biceps obliquely to end in axillary glands, others continuing between pectoralis major & deltoid to end in subclavian glands.

Deep – Accompany radial, ulnar, & interosseous arteries, passing through glands occasionally found along these arteries, and communicating at intervals with superficial lymphatics. They then pass through glands on inner side of brachial artery, and through axillary & subclavian glands, and open, on left side into thoracic duct, on right side into right lymphatic duct.

GLANDS.

Superficial – Not constant; occasionally two or three small ones at bend of elbow, and one or two just above inner condyle.

Deep – May be divided into:

Radial } – Not constant. Occasionally two or three small ones along corresponding
Ulnar } arteries.

Brachial – Form a chain of small glands along inner side of artery.

Axillary – Ten or twelve, much larger. Lie: –

1. *Round axillary vessels,* – receive lymphatics of upper limb;
2. *Along lower border of pectoralis major,* – receive lymphatics from front of chest & mamma;
3. *Along lower border of teres major & latissimus dorsi,* – receive lymphatics from integument of back.

Subclavian – Two or three, beneath clavicle; connect axillary glands to deep glands of neck.

LYMPHATICS of the ABDOMEN.

PARIETAL LYMPHATICS — Those of the hypogastric, lumbar, & epigastric region accompany respectively: – 1. the *epigastric & circumflex iliac* vessels, and open, the superficial ones into the superior or abdominal group of inguinal lymphatic glands, the dee ones into external iliac glands; – 2. the *superior epigastric* vessels, and join with th lymphatics of the thorax; – 3. the *lumbar & ilio-lumbar* vessels, and open into the lumbar gland

VISCERAL LYMPHATICS — Those of the

Intestine – Are superficial & deep, the former running longitudinally beneath the peritoneum, the latter circularly in the submucous tissue. The lymphatics of th small intestine or lacteals open into the *mesenteric glands*, which glands vary i number from a hundred to a hundred & fifty, and in size from that of a pea t that of a small almond, and are largest & most numerous near the duodenu & near the ilio-cœcal valve. The lymphatics of the large intestine are les numerous; they pass through the glands found in the meso-colon along th arches formed by the colic arteries, and they then open, those of the cœcun ascending & transverse colon, into the mesenteric glands, those of the descending colon & sigmoid flexure, into the lumbar gland

Stomach – Are superficial & deep, the former arising beneath the peritoneum, the latt in the submucous coat. They accompany the gastric & gastro-epiploic vessels the vasa brevia, and open into the pyloric & splenic glands, and some of the into one of the lacteals previous to its termination in the thoracic duc

Liver – Are superficial & deep.

SUPERFICIAL LYMPHATICS – Those of the

Upper Surface – Form four groups as follows: – 1. Some wind rou anterior border of liver, and join lymphatics of under surface. 2. Som ascend in suspensory ligament, perforate diaphragm, and open into anterior mediastinal glands. – 3. Some pass to the left, perforate diaphragn and open into anterior mediastinal glands. – 4. Some pass to the righ and either perforate diaphragm to enter anterior mediastinal gland or cross right crus of diaphragm and open directly into thoracic duc

Under Surface – Form three groups as follows: – 1. Those surrounding the gall-bladder accompany the hepatic vessels, and open into th glands along lesser curvature of stomach. – 2. Those on the rig side of the gall-bladder enter the lumbar glands. – 3. Those on the le side of the gall-bladder open into the glands along lesser curvature stomach & into the œsophageal gland

DEEP LYMPHATICS – Accompany the hepatic artery, bile duct, & portal vein in th portal canals, and, emerging at the transverse fissure, either join one the lacteal vessels previous to its termination in the thoracic duct or ope into the glands along the lesser curvature of stomach & behind th pancrea

Spleen – Are superficial & deep. They pass through some small glands at the hilu receive the lymphatics of the pancreas, and open into the thoracic duc

Kidney – Are superficial & deep. Receive the lymphatics from the suprarenal capsule ureter, and open into the lumbar gland

LYMPHATICS of the PELVIS.

GLANDS — Are the

External Iliac – Form an uninterrupted chain round the external iliac vessels, three or four of them lying round the commencement of these vessels just behind Poupart's ligament. They receive all the lymphatics of the lower limb, except the gluteal & the sciatic; their efferent vessels open into the lumbar glands.

Internal Iliac – Surround the internal iliac vessels; and receive the gluteal & sciatic lymphatics, & the lymphatics from the pelvic viscera.

Sacral – Lie on the anterior aspect of the sacrum within or sometimes externally to the meso-rectum, in the course more particularly of the rectal lymphatics.

Lumbar – Large & numerous. Lie in front of lumbar vertebræ, round common iliac vessels, aorta & vena cava, and receive the efferent vessels of all the foregoing glands, that is to say, the united trunks of the lower limb & pelvis; their efferent vessels unite into four or five large trunks which, with the lacteals, open into the receptaculum chyli.

VESSELS — Those of the

Bladder – Arise from its whole extent. They run mainly beneath the peritoneum on its posterior surface, and, after passing through a few small glands in that situation, they join with the lymphatics of the vesiculæ seminales & prostate, and open into the internal iliac glands.

Rectum – Are large & numerous. They pass through a few small glands on the outer surface of the organ & in the meso-rectum, and then ascend through the sacral to the lumbar glands.

Uterus & Vagina – May be divided into superficial & deep. Those from the cervix uteri & vagina open into the sacral & internal iliac glands. Those from the body & fundus of the uterus pass outwards within the broad ligament, receive the lymphatics from the ovaries & Fallopian tubes, and ascend with the ovarian vessels to open into the lumbar glands; they are small in the unimpregnated state of the uterus, but they enlarge greatly during gestation.

Testicle – May be divided into superficial, arising beneath the tunica vaginalis, and deep, arising from the body of the organ & the epididymis; they form several large trunks which accompany the spermatic vessels along the cord & into the abdomen, and open into the lumbar glands.

Penis & Labia – Their deep lymphatics accompany the internal pudic vessels, and open into the internal iliac glands.

LYMPHATICS of the LOWER LIMB.

VESSELS — Are superficial & deep.

Superficial – Arise from skin of foot, chiefly on dorsal aspect, and ascend upon leg dividing into

Inner Set – The larger & more numerous. Ascend some in front of & some behind internal malleolus, accompany internal saphenous vein along inne side of leg, behind inner condyle, & along inner aspect of thigh, and open into the inferior or femoral group of inguinal lymphatic glands

Outer Set – Smaller & less numerous. Some of them pass upwards & inwards over front of leg, and, crossing the tibia, open into the inner set. Others ascend behind external malleolus with external or short saphenous vein accompany that vein along back of leg, and open into the popliteal glands

Deep – Accompany the anterior & posterior tibial & peroneal vessels, and open into the popliteal glands, the efferent vessels of which glands accompany the femoral vessels and open into the deep inguinal glands. – The deep lymphatics of the gluteal & ischiatic regions accompany the gluteal & sciatic vessels, and open into the gluteal & sciatic glands

GLANDS — Are superficial & deep.

Superficial Inguinal Glands — Nine or ten in number, and divided into two groups

Superior or Abdominal Group – The smaller, placed transversely near Poupart's ligament; receive the superficial lymphatics of the penis, scrotum (o labia), perinæum, lower part of the abdomen, & buttock

Inferior or Femoral Group – The larger, vertically disposed round upper part o saphenous vein; receive the superficial lymphatics of the lower limb Their efferent vessels join the deep inguinal glands & the small gland which is found in the femoral canal

Deep Glands – Are the:

Anterior Tibial – Not constant; frequently one or two in front of upper part o interosseous membrane by side of anterior tibial artery; receive the anterior tibial lymphatics

Popliteal – Four or five, imbedded in cellular tissue of popliteal space; receiv posterior tibial & peroneal lymphatics, and the lymphatics which accompany the external saphenous vein

Deep Inguinal – A few small glands accompany the femoral vessels, and communicate with the superficial inguinal glands through the saphenou opening of the fascia lata

Gluteal & Sciatic – Lie opposite great sacro-sciatic foramen, the former above, th latter below the pyriformis muscle; they receive the correspondin lymphatic vessels, and their efferent vessels open into the internal iliac gland

THE NERVE CENTRES.

COVERINGS of the BRAIN & CORD—1st Tablet.

The immediate coverings of both are three in number, and though presenting marked differences, they bear the same names, *dura mater*, *arachnoid & pia mater.*

THE DURA MATER — Is a thick, dense, fibrous membrane, which is lined internally by the parietal layer of the arachnoid.

Dura Mater of the Brain – Forms the internal periosteum of the skull; it is prolonged round all the cranial nerves, blending with their sheaths and becoming at their point of exit continuous with the pericranium; it is also prolonged into the orbit.

Its outer surface is rough & fibrillated; it is most adherent opposite the sutures at the base of the skull, and presents superiorly numerous glandulæ Pacchionii.

Its inner surface is smooth; it sends three processes inwards, the *falx cerebri* and the *tentorium* & *falx cerebelli,* in the attached margins of which processes are repectively contained the superior longitudinal, the lateral & superior petrosal, & the occipital sinuses, the falx cerebri having also the inferior longitudinal sinus in its free margin.

Its arteries are derived from the middle & small meningeal, and from the meningeal branches of the anterior & posterior ethmoidal, internal carotid, ascending pharyngeal, occipital & vertebral, which arteries however supply principally the bones of the skull. Its veins, with the exception of the two which accompany the middle meningeal, join with the diploic veins and open into the sinuses. – Its nerves are small branches from the fourth cranial nerve, the Casserian ganglion, the ophthalmic branch of the fifth, the eighth, & the sympathetic.

Dura Mater of the Cord – Differs from that of the brain in that it does not form the internal periosteum of the bodies & laminæ of the vertebræ, which periosteum is a distinct fibrous membrane separated from the dura mater by loose areolar tissue & by a plexus of veins, in that it sends no prolongations inwards, contains no sinuses, and forms, especially in the cervical & lumbar regions, but a loose sheath round the cord and the roots of the spinal nerves.

It is attached *superiorly* to the circumference of the foramen magnum, and *anteriorly* it is slightly adherent along its whole length to the posterior common ligament of the spine.

Laterally when viewed from *within,* it is seen to give attachment to the processes of the ligamentum denticulatum, and to present a double series of foramina for the passage of the anterior & posterior roots of the nerves; when viewed from *without* it is seen to form a separate sheath to the roots of the nerves as far as their point of junction, and then to be continued upon the nerves, forming part of their neurilemma.

Opposite the *termination of the cord* it blends with the pia mater to form the ligamentum centrale, which passes down to the back of the coccyx, and which, in its upper part, contains the filiform prolongation of the grey matter of the cord termed the filum terminale.

OVERINGS of the BRAIN & CORD—2nd Tablet.

THE ARACHNOID

Is a serous membrane of which the parietal layer lines the dura mater with a layer of squamous epithelial cells, while the visceral layer surrounds the brain & cord, from which it is separated by the subarachnoidean space.

Visceral Layer of the Arachnoid of the Brain — On the upper surface of the hemispheres it is thin & transparent, and passes over the convolutions without dipping into the sulci. – At the base of the brain it is thicker and slightly opaque. Crossing from side to side between the two temporo-sphenoidal lobes and between the two hemispheres of the cerebellum & the medulla oblongata, it bounds inferiorly the *anterior & posterior subarachnoidean spaces.*

It is reflected round the cranial nerves in the shape of loose sheaths as far as their point of exit from the skull, where it becomes continuous with the parietal layer.

Visceral layer of the Arachnoid of the Cord — Forms, especially in the lower part, but a loose sheath round the cord & the roots of the nerves.

This sheath is single round the two roots of each spinal nerve, and is continued as far as their exit from the dura mater; the arachnoid is also reflected over the processes of the ligamentum denticulatum.

THE SUBARACHNOIDEAN SPACE

Is comprised between the pia mater & the visceral layer of the arachnoid, and contains the cerebro-spinal fluid. It usually communicates with the general ventricular cavity of the brain by an opening in the layer of pia mater which bounds the fourth ventricle inferiorly.

It is narrow on the surface of the hemispheres, but is greatly expanded both at the base of the brain in the situation of the anterior & posterior subarachnoidean spaces, and also round the spinal cord.

It is crossed by numerous fibrous bands in the situation of the base of the brain and at the upper part of the back of the cord, and is partly subdivided by an incomplete membranous septum which connects the arachnoid with the pia mater opposite the posterior median fissure.

COVERINGS of the BRAIN & CORD—3rd Tablet.

THE PIA MATER

On the cerebrum & cerebellum the pia mater is a delicate areolar membrane, very thin & vascular. It is thick, dense, and but slightly vascular, on the pons, the crura cerebri & the cord.

It is everywhere intimately adherent to the nervous substance; it dips down between the convolutions of the cerebrum and the laminæ of the cerebellum, and passes into the anterior and posterior median fissures of the cord; it is prolonged upon the nerves and their roots.

The pia mater of the brain penetrates into the ventricular cavities through the transverse fissure, and forms the velum interpositum and the choroid plexuses. – It usually presents an opening at the lower extremity of the fourth ventricle, by which opening the subarachnoidean space of the brain & cord communicates with the ventricular cavities of the brain.

The pia mater of the cord presents anteriorly the linea splendens, a whitish longitudinal fibrous band, and laterally, the ligamentum denticulatum. This latter descends along the whole length of the side of the cord between the anterior & the posterior roots of the nerves; its outer edge is denticulated; the denticulations, about twenty-two in number, cross the subarachnoidean space with the arachnoid reflected over them, and become attached to the dura mater in the intervals of the successive pairs of spinal nerves. The first denticulation is situated opposite the foramen magnum, between the vertebral artery & the hypoglossal nerve. — Opposite the termination of the cord the pia mater blends with the dura mater to form the ligamentum centrale, which latter passes down to the back of the coccyx, and, in its upper part, contains the filiform prolongation of the grey matter of the cord, termed the filum terminale.

HE SPINAL CORD

Extends from point of decussation of anterior pyramids (which point corresponds pretty nearly to the upper border of the atlas) to lower border of body of first lumbar vertebra, where it terminates in a slender filament, the filum terminale, which descends for a short distance into the ligamentum centrale.

Is from 15 to 18 inches long & slightly flattened from before backwards. Presents two enlargements, the cervical and the lumbar. The cervical, the larger, extends from the third cervical to the first dorsal vertebra, and is widest from side to side; the lumbar, the smaller, is situated opposite the last dorsal vertebra, and is widest from before backwards.

Presents fissures and columns.

FISSURES:

Antero-Median – Wider than the posterior, and penetrates to about one third of the thickness of the cord, its depth increasing slightly inferiorly. It contains a well-marked prolongation of the pia mater, and is bounded behind by the anterior or white commissure.

Postero-Median – Narrower than the anterior. It penetrates to the very centre of the cord, is most marked above and below, and contains but a very delicate process of pia mater. It is bounded in front by the posterior or grey commissure.

Antero-Lateral (So-called) – Consist simply of a linear series of foramina corresponding to the points of emergence of the anterior roots of the spinal nerves.

Postero-Lateral – Correspond to the line of attachment of the posterior roots, and lead down to the grey matter.

Postero-Intermediary (Hirschfeldt, Sappey) – Two delicate longitudinal furrows situated on either side of the postero-median fissure and most marked in the cervical region.

COLUMNS – Are demarcated by the fissures, and are termed

Anterior, Lateral, Posterior and Postero-Median – The two former being usually joined under the name of antero-lateral, and the postero-median being usually included in the posterior.

Gives off 31 pairs of nerves.

STRUCTURE of the SPINAL CORD—1st Tablet.

Presents for examination the grey & the white matter and the neuroglia.

GREY MATTER.

Its Arrangement – Internal. Most abundant in the enlargements & in the lumbar region, and exists alone towards lower end of cord; least abundant in the dorsal region. Disposed in a series of superimposed masses or segments, which form the nuclei of origin of the spinal nerves (Stilling). In the greater part of the cord it presents on a transverse section two anteriorly converging crescentic masses, convex internally & joined by a transverse band, and offers therefore for description:

ANTERIOR CORNUA – Short & thick, dentated at their extremity. Pass forwards & outwards towards antero-lateral fissure.

POSTERIOR CORNUA – Long & narrow; longest in the cervical region, narrowest in the dorsal, rather thicker in the lumbar. Pass backwards & outwards to very near posterior lateral fissure. Their extremity is somewhat enlarged, and presents superficially the *substantia gelatinosa,* a modification of the grey matter which is slightly transparent.

POSTERIOR OR GREY COMMISSURE – Lies behind the anterior or white commissure, a little in front of the centre of the cord. It contains the central canal of the cord, which canal is about 1-100th of an inch in diameter, is lined with columnar ciliated epithelium, and opens superiorly into the cavity of the 4th ventricle.

To the foregoing parts the two following have been added by the investigations of Mr. Lockhart Clarke:–

LATERAL INTERMEDIATE TRACT – Projects outwards from the concavity of the crescent opposite the grey commissure. Extends along the cord from upper part of cervical region to upper part of lumbar, being interrupted however at lower part of neck; is largest in the dorsal region.

POSTERIOR VESICULAR TRACT – Lies in, and partly fills up, the recess between the grey commissure & the posterior cornu. Extends from middle of cervical region to lower part of lumbar, and increases in size in the cervical & the lumbar swellings.

Towards the lower part of the cord the grey matter is collected into a central crucial or indented mass.

Its Structure – Consists of nerve-cells, which are of two kinds, the large & the small, and which are more or less intermixed with nerve-fibres & neuroglia.

LARGE NERVE-CELLS – From 1-200th to 1-400th of an inch. Most abundant in the anterior cornua, where they are disposed in an inner & an outer group. Rather less abundant & smaller posteriorly, where they are mainly collected in the posterior vesicular tracts.

SMALL NERVE-CELLS – Average from 1-600th to 1-1200th of an inch; some are said to be as small as 1-3000th of an inch, but many of these very small cells are now believed to belong to the neuroglia. The small cells are scattered throughout the whole of the grey matter, but are principally collected in the substantia gelatinosa & the lateral intermediate tract.

WHITE MATTER — External; entirely surrounds the grey matter, except in the situation of the posterior or grey commissure. Deficient at the lower end of the cord; steadily increases in quantity from below upwards. – In structure it consists of neuroglia & of nerve-fibres of various sizes, the course of which fibres will be examined in the two following Tablets.

NEUROGLIA — The neuroglia or connective tissue is very abundant, especially in the posterior cornua of the grey matter, and in the immediate vicinity of the central canal. It forms a delicate network sometimes difficult to distinguish from the nervous substance itself, in which network are seen here and there, both free nuclei and also, according to Kölliker, a few nucleated cells with numerous ramifying processes. On the inner aspect of the posterior columns it forms, with a few delicate nerve-fibres, the two *cuneiform bands of Goll.*

STRUCTURE of the SPINAL CORD—2nd Tablet.

WHITE FIBRES

Are the fibres of the roots of the nerves and the proper fibres of the white columns, which latter are to a great extent the continuation of the former after they have entered into and again emerged from the grey matter.

FIBRES OF THE ROOTS OF THE NERVES.

Fibres of Anterior Roots – Cross antero-lateral columns horizontally & in distinct bundles to anterior cornu of grey matter, and divide into three sets

INNER SET – Through large cells of inner group, and then through anterior or white commissure to anterior & lateral columns of opposite side.

MIDDLE SET – Radiate through the grey substance, and become ascending, descending & antero-posterior, the antero-posterior fibres either ending in the cells of the lateral intermediate tract or joining the fibres of the posterior roots of the nerves.

OUTER SET – Through large cells of outer group into anterior & lateral columns of same side.

Fibres of Posterior Roots – Diverge in the substantia gelatinosa, and then divide into three sets.

OBLIQUE SET – Run upwards & downwards for a variable distance with proper fibres of posterior columns before they enter the grey matter. Some of the ascending fibres pass up directly to the ganglia of the base of the brain without entering into any connection whatever with the vesicular substance.

INNER SET – Through posterior or grey commissure to lateral & posterior columns of opposite side.

OUTER SET – Through grey substance to anterior & lateral columns of same side, some becoming continuous with fibres of anterior roots. – Many of the fibres of the two latter sets are more or less oblique upwards or downwards.

PROPER FIBRES OF THE COLUMNS — Pass upwards & downwards for a variable distance connecting the cells of the different segments of the grey matter. Some are believed to pass up uninterruptedly to the ganglia of the base of the brain.

STRUCTURE of the SPINAL CORD—3rd Tablet.

Continuation Upwards of the White Fibres of the Columns into the Medulla Oblongata.

Anterior Column – Is thrust aside in the medulla oblongata by those antero-internal fibres of the lateral column, which, after decussating in the middle line, form the innermost & greater part of the anterior pyramid of the opposite side. It then divides into three bundles as follows:

Innermost Bundle – Joins externally the above mentioned antero-internal fibres of the lateral tract, and forms the smaller & outermost part of the anterior pyramid of the same side.

Middle Bundle – Surrounds the olivary nucleus, above which it forms, with a few fibres arising from this nucleus, the olivary fasciculus or fillet.

External or Posterior Bundle – Passes upwards & backwards to join the processus cuneatus, and goes to form part of the inferior peduncle of the cerebellum.

Lateral Column – Divides into three bundles as follows:

Antero-Internal Bundle – Passes forwards & inwards between the anterior columns, thrusting these columns aside, and forms, after decussating in the middle line, the innermost & greater part of the anterior pyramid of the opposite side.

Middle Bundle – Ascends with the fasciculus gracilis beneath the grey matter of the floor of the 4th ventricle, forming part of the fasciculus teres.

External or Posterior Bundle – Passes upwards & backwards to join the fasciculus cuneatus, and goes to form part of the inferior peduncle of the cerebellum.

Posterior Column – Divides into two bundles as follows:

Internal Bundle or Fasciculus Gracilis – The smaller. Ascends beneath the grey matter of the floor of the 4th ventricle, and goes to form part of the fasciculus teres.

External Bundle or Fasciculus Cuneatus – The larger. Diverges from its fellow at the apex of the calamus scriptorius, and passes upwards & outwards to form the greater part of the inferior peduncle of the cerebellum.

N.—The reader is here reminded once for all that by the "continuation" of nerve-fibres referred to in this & other Tablets, the Author means, not the continuation of the individual tubular fibres (respecting the absolute origin & termination of which tubular fibres little is yet positively known), but the continuation of the several *bundles* of nerve-fibres, which continuation is marked by the general direction of the fibres.

THE MEDULLA OBLONGATA.

The upper enlarged part of spinal cord.

Extends from lower border of Pons Varolii, above, to point of decussation of anterior pyramids below, which point corresponds pretty nearly to upper border of atlas.

Flattened from above downwards and forwards, and presents:

Antero-inferior Aspect – Rests upon basilar groove.

Postero-superior Aspect – Forms part superiorly of floor of 4th ventricle, and is continuous inferiorly with posterior surface of cord.

Divided, as is the cord, into two lateral halves, by

Antero-Median Fissure – Continuous below with that of cord, being partly interrupted, however, by decussation of anterior pyramids. Terminates above, just below the pons, in a small recess, the foramen cœcum.

Postero-Median Fissure – Continued above into ventricle of Arantius & postero-median fissure on floor of 4th ventricle, and below into postero-median fissure of cord.

SURFACE OF THE MEDULLA OBLONGATA.

Each half presents from before backwards between the two median fissures:

Anterior Pyramid – Pyramidal-shaped bundle of white fibres, the apparent prolongation of anterior column of cord; narrow below, enlarged and rounded off above, constricted just below the pons. Gives origin in its upper part to 6th cranial nerve.

Olivary Body – Oval prominent mass broader above than below, shorter than, but about as broad as, the pyramid. – It is separated from the pyramid by a narrow groove, which gives origin to 9th or hypo-glossal nerve, and from the lower part of which numerous arciform fibres are seen to proceed. These wind upwards and outwards round lower end of olivary body, sometimes crossing its surface. A few arciform fibres emerge from the anterior median fissure, and cross anterior aspect of pyramid (Sappey, Hirschfeld).

Lateral Tract – Is continuous with lateral column of cord. It is broad below, where it includes all that part of the medulla comprised between anterior pyramid and restiform body; above it is pushed backwards, and is narrowed, by the projection of the olivary body. It is separated from restiform body by a slight groove situated in a line with posterior lateral fissure of cord, and gives origin from above downwards to the facial, glosso-pharyngeal, pneumogastric & spinal accessory nerves.

Restiform Body or Fasciculus Cuneatus – Is the outer & larger, while the

Posterior Pyramid or Fasciculus Gracilis – Is the inner & smaller portion of a wide & thick bundle of white fibres continuous below with posterior column of cord, which bundle diverges from its fellow superiorly, and thus both exposes grey matter of floor of 4th ventricle and forms lower part of lateral boundary of that cavity. This wide & thick bundle used to be called, and is still sometimes called *the* restiform body. – From its inner edge there projects inwards a thin lamina of white matter termed the *ligula,* which may be considered as forming part of roof of 4th ventricle. Opposite apex of calamus scriptorius the posterior pyramid presents an enlargement, the *processus clavatus.* In front of the processus cuneatus, behind & a little below olivary body & in a line with postero-lateral fissure of cord, is a small greyish eminence, the *grey tubercle of Rolando,* which is formed by the projection of the substantia gelatinosa.

Grey Matter of Floor of 4th Ventricle – Vide 4th Ventricle.

STRUCTURE of the MEDULLA OBLONGATA—1st Tablet.

Presents for examination longitudinal, antero-posterior & transverse fibres, and grey matter.

LONGITUDINAL FIBRES — Form five bundles continuous on the one hand with the columns of the cord, and on the other with the longitudinal fibres of the mesocephalon, *i.e.*, three large ones, *anterior pyramid, lateral tract & fasciculus cuneatus*, and two smaller ones, *olivary fasciculus or fillet, & posterior pyramid or fasciculus gracilis.*

Their mode of Continuation with the Columns of the Cord – Is as follows: –

Anterior Pyramid – With antero-internal bundle of lateral column of opposite side, and with innermost bundle of anterior column of same side. The former bundle forms the innermost decussating & by far greater portion of the anterior pyramid; the latter bundle forms that small outer portion of the ant. pyramid, the fibres of which do not decussate in the middle line.

Lateral Tract – With lateral column of same side.

Fasciculus Cuneatus – With external & greater part of posterior column, and with external or posterior bundles of anterior & lateral columns all of same side.

Olivary Fasciculus or Fillet – Partly with middle bundle of anterior column of same side; its other fibres are derived from the olivary nucleus.

Posterior Pyramid or Fasciculus Gracilis – With posterior column of same side.

Their mode of Continuation with the Longitudinal Fibres of the Meso-cephalon – Is as follows: –

Anterior Pyramid – Ascends through the mesocephalon to the inferior or fasciculated portion of the crus cerebri, from whence its fibres are prolonged to the corpora striata.

N.—The cerebellar fibres & the fibres to the olivary body, which are said in some of our best standard works on Anatomy to be derived from the anterior pyramid, are derived not from the anterior pyramid itself, that is to say not from the pyramidal-shaped bundle, which, in the *surface description* of the cord, is called the "anterior pyramid," but from the middle & external bundles of the *anterior column of the cord.* (Vide continuation upwards of the white fibres of the columns of the cord into the medulla oblongata).

Lateral Tract – Divides into three bundles as follows (or rather it is the *lateral column of the cord* which thus divides, for the division here referred to takes place a little below the point of decussation of the pyramids, that is to say below the point which is usually taken as the boundary between the medulla & the cord): –

- *Antero-internal Bundle* – Passes upwards & inwards, decussating with its fellow, and forms the innermost & greater part of the anterior pyramid of the opposite side.
- *Middle Bundle* – Ascends with the fasciculus gracilis beneath the grey matter of the floor of the 4th ventricle, forming part of the fasciculus teres.
- *External or Posterior Bundle* – Passes upwards & backwards to join the fasciculus cuneatus, and goes to form part of the inferior peduncle of the cerebellum.

Fasciculus Cuneatus – Passes up to the cerebellum with the external or posterior bundles of the anterior & lateral columns of the cord, forming with them the inf. peduncle of the cerebellum.

Olivary Fasciculus or Fillet – Divides into two bundles as follows : –

- *Antero-internal Bundle* – Ascends through the mesocephalon with the middle bundle of fibres of the lateral tract, and joins the upper part or tegmentum of the crus cerebri.
- *Postero-external Bundle* – Passes upwards & outwards through the mesocephalon, issues from the transverse fibres of the pons externally to the crus cerebri, and finally ascends over the superior peduncle of the cerebellum to the tubercula quadrigemina, decussating with its fellow above the aqueduct of Sylvius.

Posterior Pyramid or Fasciculus Gracilis – Ascends with the middle bundle of the lateral column beneath the grey matter of the floor of the 4th ventricle, forming part of the fasciculus teres.

ANTERO-POSTERIOR FIBRES — Form a median septum most marked at the upper part of the medulla. They partly decussate with each other (Clarke). Some emerge from the antero-median fissure, or pass between the anterior pyramid & the olivary body and emerge below the roots of the 9th nerve; these two sets form the arciform fibres mentioned in the surface description of the medulla. Others emerge from the postero-median fissure, and form the lineæ transversæ of the floor of the 4th ventricle.

TRANSVERSE FIBRES — The arciform fibres form a superficial set. A deep set join the olivary nuclei & the nuclei contained in the posterior pyramids & processus cuneati.

GREY MATTER —Vide next Tablet.

STRUCTURE of the MEDULLA OBLONGATA--2nd T.

GREY MATTER — May be examined in three principal situations as follows:

Inferiorly, or at Junction of Medulla with Cord – It is here disposed as in the cord, except that the transverse commissure is broader, and that, with the central canal (which latter is usually blocked up with a little granular matter) it progressively approaches the posterior aspect of the medulla.

Towards Middle of Medulla – The following changes take place: –

I. Anterior Cornua & Lateral Intermediate Tracts become indistinct and soon vanish away in the form of a radiating network of fibres & cells. In front of this network, *i.e.*, between it & the anterior pyramid, there soon appears on either side, the olivary nucleus or corpus dentatum, which latter is unconnected with the grey matter prolonged upwards from the cord. – The corpus dentatum is a hollow bag or capsule of grey matter open at its upper & inner part, and presenting on section a dentated outline. Some of the deep transverse fibres of the medulla pass into this capsule; other fibres emerge from it, and joining the middle bundle of fibres of the anterior column of the cord, form the olivary fasciculus or fillet, which passes up through the mesocephalon both to the corpora quadrigemina & the cerebral hemispheres.

II. Posterior Cornua become more & more transverse in direction and finally curve slightly forwards. The substantia gelatinosa, which caps their extremity, expands into a large rounded mass, which reaches the surface below & in front of the restiform body and forms the grey tubercle of Rolando; higher up, this mass becomes the chief nucleus for the sensory portion of the 5th nerve. Behind the posterior cornua two new cornua appear, which extend, the one into the fasciculus cuneatus, the other into the posterior pyramid; both these new cornua increase in size from below upwards.

Superiorly, where Medulla passes into Mesocephalon – The central canal expands into 4th ventricle, and the grey matter spreads out on floor of that cavity. Here it forms in the upper half of the space the nuclei for the 6th & 7th nerves, and in the lower half & close to the postero-median fissure, the nucleus for the hypoglossal nerve, & externally to this nucleus & from above downwards, the nuclei for the following nerves, *i.e.*, auditory, glosso-pharyngeal, pneumogastric & accessory portion of spinal accessory; the nuclei of the hypoglossal & accessory portion of the spinal accessory being also prolonged for some distance into the concealed portion of the grey matter, the former nucleus in front of the central canal, the latter behind it (Stilling, Clarke).

Note – From recent statements by Mr. Lockhart Clarke there appear to exist *three other nuclei* on the floor of the fourth ventricle in addition to those above described, namely, *two nuclei for the 5th Nerve*, one sensory & one motor, and *an additional nucleus for the Auditory Nerve*.

The two nuclei for the 5th Nerve are situated at the *outer angle* of the floor of the fourth ventricle; the more *external or sensory* nucleus is continuous below with the grey tubercle of Rolando; the more *internal or motor* nucleus lies just internally to foregoing.

In addition to the *Auditory Nucleus* above described, which nucleus is now termed the *internal auditory nucleus*, there exists another nucleus higher up & more to the outer side, between the two nuclei for the 5th nerve, above, and the nucleus for the glosso-pharyngeal nerve below; this is the *external auditory nucleus*. – In correspondence with the above statements, the auditory nerve would have another, deeper, or more anterior set of fibres. These fibres arise from the *external auditory nucleus*; they pass outwards *through the substance of the restiform body*, and join, externally to that body, with the bundle & fibres hitherto recognised.

Some of the fibres of the *4th Nerve* are said to arise from a nucleus on outer side of locus cœruleus.

THE CEREBELLUM.

Oblong from side to side & flattened from above downwards. Presents two surfaces & a circumference, and consists of two lateral hemispheres connected by a median lobe, the vermiform process, which latter is divided into two parts, the superior & the inferior.

UPPER SURFACE — Flattened on either side, slightly elevated in the centre. Presents:

Superior Vermiform Process – Presents from before backwards three slight elevations, the

Lobulus Centralis, Monticulus Cerebelli, & Commissura Simplex, which latter joins with the commissura brevis of the inferior vermiform process.

Lateral Hemispheres – Divided by a deep fissure into

Anterior or Square Lobe, the anterior, inner & broader portion, and the
Posterior or Semilunar Lobe, the narrow, posterior or marginal portion.

UNDER SURFACE — Rounded & elevated laterally and depressed in the centre. Presents:

Inferior Vermiform Process – Lies in a deep depression, the *valley* or *vallecula* comprised between the two hemispheres, and presents from behind forwards the

Commissura Brevis, Pyramid & Uvula, the former of which joins with the commissura simplex of the superior vermiform process.

The uvula is situated between the two *tonsils*, with which it is connected by a grey commissure the *furrowed band*. Its rounded apex, the *nodule* or *laminated tubercle of Malacarne* projects into the 4th ventricle, and is connected with the flocculi by a thin valvular fold of white substance, the *posterior medullary velum* or *commissura ad flocculum*, which fold is partly covered in & concealed by the tonsils.

Lateral Hemispheres – Present five lobes:

Flocculus, Sub-Peduncular Lobe, or Pneumogastric Lobule – Prominent tuft subdivided into several small laminæ and situated below & behind the middle peduncle of the cerebellum, behind the roots of the pneumogastric nerve.

Amygdala or Tonsil – Rather larger than foregoing and similarly subdivided; projects into the valley on either side of the uvula, to which it is connected by the furrowed band.

Digastric Lobe – Corresponds in situation to the anterior part of the square lobe of the upper surface.

Slender Lobe – Corresponds in situation to the posterior part of the foregoing square lobe.

Posterior Inferior Lobe – Corresponds in situation to the posterior or semilunar lobe.

CIRCUMFERENCE — Deeply notched in front & behind by the

Incisuræ Cerebelli Anterior & Posterior, – Of which the former embraces the tubercula quadrigemina & the superior peduncles, while the latter receives the falx cerebelli; – also divided into upper & lower lips by the

Great Horizontal Fissure – Which extends uninterruptedly from one middle peduncle to the other.

The other fissures are more or less parallel to the foregoing, and describe more or less concentric curves concave forwards & inwards; some fissures however are more or less oblique, and coalesce with the others so as not to extend over the whole breadth of the hemispheres. The largest fissures separate the lobes above described, the smaller ones demarcate the laminæ or folia, which latter cover the surface of the cerebellum and project also into the bottom of the larger fissures.

STRUCTURE of the CEREBELLUM.

APPARENT TO THE NAKED EYE:

Central White Stem, – Which contains the corpus dentatum, and from the surface of which from 12 to 16 primary laminæ are given off. These laminæ, as well as the secondary laminæ which they give off in their turn, and also the tertiary laminæ given off by the secondary, are covered with

Grey Matter – Divided into two, and in some places into three layers, which layers are respectively from without inwards dark grey, pale or rusty, light grey. The arborescent appearance of these two substances, when viewed together on section, is termed the *arbor vitæ.*

Corpus Dentatum – Is a plicated bag of grey matter open above & in front, and situated in the white stem not far from the middle line. On section it presents a wavy dentated outline. White fibres are contained in its interior, which fibres issue forth from it and join the superior peduncle.

MINUTE OR MICROSCOPICAL.

White Fibres – Are of two kinds:

Central or Peduncular – Converge from the central part of the laminæ towards the three peduncles, into which they are continued (Vide below)

Superficial or Non-peduncular – Pass superficially from one lamina to anothe

Grey Matter – Contains:

Large Caudate Nerve-cells with nucleus, nucleolus & granular contents, which cells, with the finely granular material in which they lie, form the most superficial & the deepest of the three layers of the grey matter. Their caudate prolongations are continued into branched processes mainly turned towards the surface of the organ, which processes probably join the terminal ramifications of the nerve-fibres (Kölliker, Gerlach).

Cell-Nuclei densely aggregated without any intervening substance. These nuclei form the greater part of the pale intermediate layer of the grey matter.

Terminal Extremities of the Nerve Fibres – End in a fine network, the ramifications of which are probably continuous with the caudate prolongations of the nerve-cells (Kölliker, Gerlach).

Large Pellucid Cells, and other Cells & Nuclei belonging to the connective tissue.

(See Page 230.)

STRUCTURE of the PEDUNCLES.

They consist of white fibres only.

Superior, or Processus e Cerebello ad Testes – Arises in the laminæ of the inferior vermiform process and also in the interior of the corpus dentatum, passes upwards & inwards on either side of the middle line, being joined to its fellow by the valve of Vieussens, and ascends beneath the tubercula quadrigemina to the crura cerebri & optic thalami, partly decussating in the middle line.

Middle, Processus e Cerebello ad Pontem or Crus Cerebelli – The great transverse commissure of the cerebellum. Connects the laminæ of the lateral parts of one hemisphere to the corresponding laminæ of the opposite side, and forms the pons Varolii & the deep transverse fibres of the mesocephalon.

Inferior, or Processus e Cerebello ad Medullam – If traced from below upwards, it may be said to proceed from all three columns of the cord, *i.e.,* from the postero-external bundles of the anterior & middle columns, & from the fasciculus cuneatus or external bundle of the posterior column, the latter bundle being much the largest of the three. It ends in the laminæ of the middle part of the cerebellum, especially in those of the upper surface.

THE FOURTH VENTRICLE.

Rhomboidal cavity bounded by the medulla oblongata & mesocephalon below & in front and the cerebellum above & behind, and closed in inferiorly by the layer of pia matter extending between these parts. Presents:

FLOOR — Lozenge-shaped, oblique downwards & backwards, covered by a stratum of grey matter from which arise the 6th, 7th, 8th, & 9th nerves * (Vide structure of medulla oblongata, 2nd Tablet); bounded on either side below by the posterior pyramids & restiform bodies, and above by the processus e cerebello ad testes. Presents the following parts, which give rise to the appearance termed the *calamus scriptorius*.

Postero-Median Fissure – Continued above into the aqueduct of Sylvius or iter a tertio ad quartum ventriculum, below into the ventricle of Arantius or short upper expanded part of the central canal and into the postero-median fissure of the cord.

Lineæ Transversæ – A few white fibres very variable in number sometimes scarcely recognisable, which emerge from the lower part of the postero-median fissure, cross the eminentiæ teretes, and join, some of them the crus cerebelli, others the roots of the auditory nerve; a few sometimes ascend to the locus cœruleus.

Eminentiæ Teretes – Two spindle-shaped elevations, greyish & slightly marked below, whiter & more prominent above, due to the fasciculi teretes, as they ascend beneath the grey matter on either side of the postero-median fissure. – On either side of these eminences is a

Groove, or rather, in well marked bodies, TWO SMALL FOSSÆ, which lie, the posterior, inferior & narrowest one, near the lower extremity of the ventricle, and the anterior, superior & broadest one, opposite the crus cerebelli. The latter fossa leads upwards to the

Locus Cœruleus – A bluish spot due to an accumulation beneath the surface, of dark vesicular matter termed the *substantia ferruginea*. From this spot the

Tinea Violacea, – A bluish streak, the continuation upwards of the locus cæruleus, ascends on the outer side of the eminentia teres to the opening of the aqueduct of Sylvius.

ROOF — Formed above by the superior peduncles of the cerebellum & the valve of Vieussens, below by the tonsils, the inferior vermiform process with the uvula, the nodule or laminated tubercle of Malacarne, & by the posterior medullary velum or commissura ad flocculum. Still lower down is the ligula.

LATERAL BOUNDARIES — Formed by the superior peduncles of the cerebellum above, and by the diverging restiform bodies & posterior pyramids below.

UPPER EXTREMITY — Presents the opening of the aqueduct of Sylvius or iter a tertio ad quartum ventriculum.

LOWER EXTREMITY — Usually presents an opening in the layer of pia mater which bounds the ventricle inferiorly, through which opening the ventricular cavities of the brain communicate with the subarachdoidean space of the brain & cord.

Choroid Plexuses of 4th Ventricle – Vide intra-cerebral portion of the pia mater.

***Note** – And also the 4th and 5th nerves, and the external or deep root of the Auditory.

THE MESOCEPHALON

Is the connecting link between the cerebrum, cerebellum & medulla oblongata. It consists of the following parts: –

Pons Varolii or *Tuber Annulare* with the superficial & deep transverse fibres of the *Middle Peduncles of the Cerebellum ;*
Crura Cerebri divided into *under or fasciculated portion* and *upper part or tegmentum ;*
Inferior Peduncles of the Cerebellum, and *Superior Peduncles* with the *Valve of Vieussens ;*
Tubercula Quadrigemina & *Pineal Gland.*

Pons Varolii or Tuber Annulare – Broad transverse band of white fibres which arch like a bridge from one hemisphere of the cerebellum to the other, forming laterally the middle peduncles of the cerebellum. Presents: –

UNDER SURFACE – Marked by a median shallow groove for basilar artery. Gives off laterally the two roots, anterior small or motor, posterior large or sensory, of the 5th pair of cranial nerves.

UPPER BORDER – The most prominent & the most convex, from beneath which the crura cerebri are seen to emerge.

LOWER BORDER – Less prominent & less convex, into which the anterior pyramids, olivary fasciculi & lateral tracts of the medulla are seen to penetrate, and from the anterior aspect of which the 6th cranial nerves are sometimes given off. – Laterally the pons Varolii is continued into the two

Middle Peduncles of the Cerebellum or Crura Cerebelli – Which form its two lateral portions.

Crura Cerebri – Two thick cylindrical or slightly flattened bundles of white fibres about ¾ of an inch long & rather wider in front than behind, which emerge from the anterior border of the pons and pass forwards & outwards to the corpora striata & optic thalami. They are crossed externally by the 4th nerve & inferiorly by the optic tract, the anterior border of which latter is slightly adherent to them. Their inner border bounds posteriorly the interpeduncular space, and gives origin to the 3rd cranial nerve. They are divided into an under or fasciculated portion & an upper portion or tegmentum, between which two portions is a small mass of grey matter, the *locus niger.*

Inferior Peduncles of the Cerebellum or Processus e Cerebello ad Medullam – Two thick bundles of white fibres which descend from the inner & under part of the cerebellum to the back of the medulla, where they join the processus cuneati. They form the lower part of the lateral boundary of the 4th ventricle.

Superior Peduncles of the Cerebellum or Processus e Cerebello ad Testes – Two thick bundles of white fibres which ascend from the upper & inner part of the cerebellum to the testes, forming part of the roof & of the lateral boundary of the 4th ventricle. They are connected together by the

Valve of Vieussens – Thin transparent lamina of white matter narrow in front, where it presents a slight median ridge, the frenulum, and, on either side of this, the roots of the 4th nerve, broader behind, where it is continued into the under surface of the superior vermiform process and is crossed by a few transverse bands of grey matter prolonged upwards from the cerebellum. It forms the roof of the aqueduct of Sylvius & a part of the roof of the 4th ventricle.

Tubercula Quadrigemina – Four small rounded eminences separated by a crucial depression, and situated below the posterior extremity or splenium of the corpus callosum, above & behind the posterior commissure & the 3rd ventricle, above & in front of the superior peduncles of the cerebellum & the valve of Vieussens.

ANTERIOR OR NATES – Are larger, darker, slightly oblong from before backwards, and connected with the optic thalami & the commencement of the optic tracts by two broad white bands, the *brachia anteriora.*

POSTERIOR OR TESTES – Are smaller, lighter in colour, more exactly rounded, and connected with the optic thalami & the commencement of the optic tracts by two narrower bands, the *brachia posteriora.*

Pineal Gland or Conarium – Small conical reddish-grey body situated between the nates, retained in position by a fold of pia mater derived from the under surface of the velum interpositum, and connected with the remainder of the cerebrum by means of a few transverse fibres belonging to the posterior commissure, and also by means of its

PEDUNCLES – Two on each side :

Anterior or Superior – Run forwards over upper & inner part of optic thalami to anterior crura of fornix, with which they unite.

Posterior or Inferior – Descend vertically upon inner surface of optic thalami.

The pineal gland consists of grey matter with a few white fibres, and is very vascular. In its interior are one or two small cavities, which sometimes communicate with the 3rd ventricle, and which contain a transparent viscid fluid & a small amount of sabulous matter termed the *acervulus cerebri.*

STRUCTURE of the MESOCEPHALON

Presents for examination transverse, longitudinal & antero-posterior fibres, and gr
matt

TRANSVERSE FIBRES — Connect from side to side the laminæ of the lateral p
tions of the cerebellum, forming two set

Superficial Set - Constitute the pons Varolii properly so-called, and are separat
by the superficial set of *longitudinal* fibres from t

Deep Set - Which lie between, and are more or less intermingled with, the supe
cial & middle sets of *longitudinal* fibres, and are also largely intermingled w
grey matt

LONGITUDINAL FIBRES — Form three sets:-

Inferior or Superficial Set - Lie between the superficial & deep sets of the tra
verse fibres being, however, posteriorly, more or less intermixed with the latt
They are derived from the anterior pyramids of the medulla oblongata; th
form superiorly the inferior or fasciculated portion of the crus cere

Middle Set - Lie behind the deep set of transverse fibres with which however they
more or less intermingled anteriorly. They are derived from the fascic
gracilis, from the middle set of fibres of the lateral tract of the medulla & fr
the antero-internal division of the olivary fasciculus or fillet (the fibres fr
the two former sources being joined together under the name of fascic
teres. They ascend beneath the gray matter of the floor of the 4th ventri
and go to form the upper portion or tegmentum of the crus cere

Deep or Supererior Set - Are derived on the one hand from the laminæ of
inferior vermiform process & from the interior of the corpus dentatum of
cerebellum, and on the other hand from the postero-external division of
olivary fasciculus or fillet, the former set of fibres forming the superior pedu
of the cerebellum. They join the upper part or tegmentum of the crus cere

ANTERO-POSTERIOR FIBRES — Are derived partly from the floor of the
ventricle, and partly from some of the transverse fibres, which bend backwards f
short distance before they cross to the opposite s

GREY MATTER — Is largely intermixed with the deep transverse & middle longitud
fibres, and forms the locus niger of the crus cerebri & the greater part of the tul
cula quadrigemina & pineal gla

THE SURFACE of the CEREBRUM.

The cerebral hemispheres are now described as presenting five lobes: the frontal, parietal, occipital & temporo-sphenoidal lobes, and the central lobe or Island of Reil. These lobes are seen most extensively on the upper or convex surface of the hemispheres.

UPPER OR CONVEX SURFACE OF THE CEREBRUM: — Presents:

FOUR PRINCIPAL FISSURES — Which partly separate the five lobes:

ASCENDING & HORIZONTAL LIMBS OF THE FISSURE OF SYLVIUS — The former ascends in front of the central lobe and amongst the frontal convolutions. – The latter passes backwards behind the central lobe, and separates the temporo-sphenoidal lobe from the frontal & parietal lobes.

FISSURE OF ROLANDO — Begins near the middle of the longitudinal fissure and passes downwards & forwards to near the horizontal limb of the fissure of Sylvius, separating the frontal & parietal lobes.

EXTERNAL PARIETO-OCCIPITAL FISSURE — Separates the parietal and occipital lobes above. – Is very variable in extent, and is sometimes scarcely recognisable except by its being continuous with the internal parieto-occipital fissure, or perpendicular fissure of the inner surface of the hemispheres.

OUTER SURFACE OF THE FIVE LOBES:

Frontal Lobe – Presents:

Ascending Frontal Convolution – Forms the anterior boundary of the fissure of Rolando, and is continuous round the lower end of that fissure with the ascending parietal convolution. It is joined in front to the

Superior, Middle & Inferior Transverse Frontal Convolutions, – Which pass forwards one above the other to the anterior extremity of the hemisphere.

Parietal Lobe – Presents:

Ascending Parietal Convolution – Forms the posterior boundary of the fissure Rolando, and is continuous below round the lower end of that fissure, with the ascending frontal convolution. – Behind this convolution are three complex and variable convolutions termed the parietal lobule, the supra-marginal convolution & the angular gyrus.

Parietal Lobule – Is situated on the side of the longitudinal fissure between the parieto-occipital fissure, & the fissure of Rolando, and, is continuous in front with the upper part of the ascending parietal convolution, and joined behind to the superior occipital by the first annectant convolution.

Supra-marginal Convolution – Is situated below and in front of the preceding and in front of the angular gyrus. It is separated from the ascending parietal convolution by the intra-parietal fissure, and is connected behind with the angular gyrus.

Angular Gyrus – Is situated behind the preceding, below and behind the parietal lobule. It blends below with the superior & middle temporo-sphenoidal convolutions, and is connected behind with the middle occipital by the second annectant convolution.

Temporo-Sphenoidal Lobe – Presents three well marked antero-posterior convolutions, which are superposed to each other.

Sup. Temporo-Sphenoidal Convolution – Lies between the horizontal limb o the fissure of Sylvius and the parallel fissure, and is continuous behind with the angular gyrus.

Middle Temporo-sphenoidal Convolution – Is separated from the lower one by the inferior temporo-sphenoidal fissure, and is continuous posteriorly with the angular gyrus and connected by the third annectant with the middle occipital convolution.

Inf. Temporo-sphenoidal Convolution – Is partly seen on the under surface of the cerebrum, and is connected behind to the third occipital by the fourth annectant convolution.

Occipital Lobe – Presents three rather badly defined convolutions, which are superposed to each other, and are more or less antero-posterior.

Sup. Occipital Convolution – Is connected to the parietal lobule by the first annectant convolution.

Middle Occipital Convolution – Is connected to the angular gyrus & to the middle temporo-sphenoidal convolution by the second and third annectant convolutions.

Inf. Occipital Convolution – Is connected to the inferior temporo-sphenoidal convolution by the fourth annectant convolution.

Central Lobe or Island of Reil – Is deeply situated between the frontal & temporo-sphenoidal lobes at the bottom of the outer part of the fissure of Sylvius. It presents five or six convolutions, which are nearly straight and mainly directed upwards and outwards, and of which the posterior ones are the largest.

UNDER SURFACE of the CEREBRUM

Presents from before backwards

IN THE MEDIAN LINE:

Anterior part of the Longitudinal Fissure – Bounded behind by the anterio extremity or genu of the corpus callosum

Anterior Extremity or Genu of the Corpus Callosum – Curves downwards and backwards. Its narrowing reflected portion, beak or rostrum is connected with the lamina cinerea, and gives off two white bundles, th peduncles, which cross the anterior perforated space to the entrance c the fissure of Sylvius

Lamina Cinerea – A thin layer of grey substance stretching, above the optic commissure, with which it is connected, from the rostrum of the corpu callosum to the tuber cinereum, and continuous laterally with the gre matter of the anterior perforated space.

Optic Commissure or Chiasma with the **Optic Tracts** – Vide Optic Nerve

Interpeduncular Space – Lozenge-shaped, comprised between the crura cerebr and the optic tracts, and containing from before backwards

- TUBER CINEREUM with the INFUNDIBULUM & PITUITARY BODY – The former c which is a conical eminence of the grey matter of the floor of the 3r ventricle connected by a hollow infundibuliform process, the infundibulum, with the latter, which latter is a small reddish grey vascula mass divided into an anterior & a posterior lobe, and the nature c which, especially in its anterior lobe, is very similar according to D Sharpey, to that of the ductless or vascular glands. It is proportiona tely larger in the fœtus, and is then hollow, its cavity being continuou with that of the 3rd ventricle
- CORPORA ALBICANTIA – Two small round white bodies formed by the twistin upon themselves of the anterior crura of the fornix before they pas up to the optic thalam
- POSTERIOR PERFORATED SPACE – Formed by a layer of grey substance, whic constitutes the posterior part of the floor of the 3rd ventricle and i continuous around the corpora albicantia with the base of the tube cinereum. It is perforated by numerous small foramina for th passage of blood vessels to the optic thalam

Crura Cerebri – Vide Mesocephalon.

LATERALLY:

Under Surface of the Frontal Lobe – Presenting internally the lower end c the marginal convolution, on the outer side of which is the olfactor sulcus containing the olfactory nerve and bul

Anterior Perforated Space – Formed by a layer of grey substance corresponding to the under surface of the corpus striatum, and perforated b numerous small foramina for the passage of vessels to that body. It i bounded in front by the posterior and inner part of the frontal lobe an the roots of the olfactory nerve, and behind & to the inner side by th optic tract & commissure, and is continued externally into th

Fissure of Sylvius – Which separates the frontal and temporo-sphenoidal lobe and divides on the outer surface of the cerebrum into two branches o limbs, which enclose the middle lobe or Island of Reil

Under Surface of the Temporo-sphenoidal Lobe.

Behind these parts appear when the medulla oblongata & cerebellum ar removed, in the median line

Middle part of the Transverse Fissure – Comprised between th corpora quadrigemina and th

Posterior Extremity or Splenium of the Corpus Callosum – Behind which is th

Posterior Part of the Longitudinal Fissure – And laterally the

Under Surface of the Occipital lobe.

INNER SURFACE of the CEREBRUM

Presents for examination:

Marginal Convolution & Convolution of the Corpus Callosum separated from each other by the
Calloso-marginal Fissure;
Quadrate & Occipital Lobules separated from each other by the
Internal Parieto-occipital Fissure, and separated by the
Calcarine Fissure from the internal temporo-sphenoidal convolutions;
Internal Temporo-sphenoidal Convolutions, three in number, superior (dentate convolution), middle (gyrus uncinatus) & inferior, and separated from the foregoing by the above-mentioned calcarine fissure and from each other by the
Dentate & Collateral Fissures.

Marginal Convolution – Forms the lateral boundary of the anterior half of the longitudinal fissure. Beginning at the anterior perforated space, it first passes forwards on the inner side of the olfactory sulcus as far as the apex of the frontal lobe, and then curves upwards & backwards along the upper margin of the hemisphere to a little behind the fissure of Rolando.

Convolution of the Corpus Callosum or Gyrus Fornicatus – Begins anteriorly with the foregoing, and then winds backwards along the convex surface of the corpus callosum from which it is separated by the so-called ventricle. Posteriorly it joins above with the quadrate lobule, and then, becoming slightly constricted, is reflected downwards & forwards round the splenium and continued into the gyrus uncinatus.

Calloso-Marginal Fissure – Separates the two foregoing convolutions along their whole length, and then ascends to the upper margin of the hemisphere separating the marginal convolution from the quadrate lobule.

Quadrate Lobule – Quadrilateral. Bounded above, in front, & behind respectively by the margin of the hemisphere, and by the calloso-marginal & internal parieto-occipital fissures. Blends inferiorly with the gyrus fornicatus.

Occipital Lobule – Triangular. Bounded behind, in front, & below respectively by the inner margin of the hemisphere and by the internal parieto-occipital & calcarine fissures.

Internal Parieto-Occipital Fissure – Separates the two foregoing lobules. It is continuous superiorly with the external parieto-occipital fissure; inferiorly it joins with the calcarine fissure.

Calcarine Fissure – Extends horizontally forwards from the apex of the occipital lobe to the point of junction of the gyrus fornicatus with the gyrus uncinatus. It separates the occipital lobule from the middle temporo-sphenoidal convolution, and joins anteriorly with the internal parieto-occipital fissure.

Superior Temporo-Sphenoidal or Dentate Convolution – Is but a narrow band of grey matter which lies internally to the fascia dentata. It blends anteriorly with the uncus.

Dentate Fissure – Corresponds to the hippocampus major, and separates the dentate convolution from the gyrus uncinatus.

Middle Temporo-Sphenoidal Convolution or Gyrus Uncinatus – Comprised between the calcarine & collateral fissures, and extends along nearly the whole length of the temporo-sphenoidal lobe. It is slightly constricted towards its middle & enlarged in front & behind; anteriorly it presents a small hooked prolongation, the uncus, which curves upwards & backwards, and joins with the dentate convolution & with the corpus fimbriatum.

Collateral Fissure – Extends along nearly the whole length of the temporo-sphenoidal lobe, separating the gyrus uncinatus from the inferior temporo-sphenoidal convolution. It corresponds towards its middle to the eminentia collateralis.

Inferior Temporo-Sphenoidal Convolution – Appears both on the inner & under surfaces of the hemispheres, and is joined behind by the fourth annectant to the inferior occipital convolution.

INTERNAL STRUCTURE of the HEMISPHERES.

PARTS SEEN BEFORE OPENING THE VENTRICLES:

Centrum Ovale Minus – With the puncta vasculosa & the convoluted margin of the divided grey matter

Ventricle of the Corpus Callosum – Comprised between the corpus callosum & the gyrus fornicatus

Centrum Ovale Majus – Into which the fibres of the corpus callosum are continued on either side

Corpus Callosum – Thick stratum of transverse & radiating white fibres which connect the two hemispheres; arched from before backwards, thickest & broadest behind, thinnest towards centre. It presents

Upper Surface – Convex from before backwards, striated transversely, marked by a median depressed raphé which is bounded by two slightly elevated bands termed the *nerves of Lancisi.* More externally, beneath the gyru fornicatus, are other similar bands, the *striæ longitudinales laterales*

Under Surface – Blended behind with the fornix. In front, where it forms th roof of the lateral ventricles, it is connected with the fornix by the septum lucidum

Anterior Extremity or Genu – Curves downwards & backwards, presenting a narrowing reflected portion, the *beak or rostrum.* This latter is connected with the lamina cinerea, and gives off two small white bands or *peduncles* which cross the anterior perforated space to the entrance of the fissure o Sylvius

Posterior Extremity or Splenium – Thick & rounded. Forms upper boundary of middle portion of transverse fissure, and is joined in front with the fornix

HE LATERAL VENTRICLES.

Consist of a central cavity or body, and three prolongations or cornua.

Central Cavity or Body – Presents:

Roof – Formed by under surface of corpus callosum.

Inner Wall – Formed by septum lucidum.

Floor – Formed from before backwards by the *corpus striatum*, *tænia semicircularis*, *thalamus opticus*, *choroid plexus*, *corpus fimbriatum* & *fornix*.

Ant. Cornu – Passes downwards & outwards round anterior extremity of corpus striatum.

Post. Cornu or Digital Cavity – Curves backwards, downwards, outwards, and then backwards, downwards & inwards in substance of occipital lobe. On inner part of its floor is the hippocampus minor, a longitudinal eminence which corresponds to calcarine fissure of Huxley.

Middle or Descending Cornu – Curves backwards, outwards & downwards round optic thalamus, and then forwards & inwards to near anterior extremity of temporo-sphenoidal lobe. Its floor presents the *hippocampus major*, *pes hippocampi*, *pes accessorius*, *corpus fimbriatum*, *choroid plexus*, *fascia dentata* & *transverse fissure*.

PARTS SEEN on FLOOR of LATERAL VENTRICLE

Are from before backwards

CORPUS STRIATUM — Large pear-shaped mass of grey matter embedded externally in wh substance of frontal lobe. Presen

Ant. Extremity – Broad; projects into anterior part of body of lateral ventricle, forming p of its floor, and into anterior cornu of the same cavi

Post. Extremity – Narrow; passes backwards and outwards on outer side of optic thalamus

The corpus striatum is divided into two portions, the intra- & extra-ventricul by a layer or stratum of ascending & diverging white fibres which form the *pe* or the *corona radiata of Reil.* Part of these fibres are derived from the inferior or f ciculated portion, and also from the upper part or tegmentum, of the crus cereb part of them originate in the corpus striat

TŒNIA SEMICIRCULARIS — Whitish semi-transparent band of fibres, which descends teriorly in connection with anterior crus of fornix, and is lost posteriorly in descendi cornu of lateral ventricle; it partly conceals the vena corporis stria

OPTIC THALAMUS — Large ovoid mass of grey matter white superficially, similar to cor striatum, behind & internally to which it is situated, and similarly traversed by numer ascending & diverging white fibres, which are partly derived from upper portion of c cerebri, olivary fasciculus, fasciculus teres, processus e cerebello ad testes & corpora qua gemina, and which partly originate in the thalamus. Presen

Ant. Extremity – Narrow, situated behind anterior crus of fornix; forms posterior boundary foramen of Mo

Post. Extremity – Broad & rounded. Projects into descending cornu of lateral ventricle, a is continuous on inner side with tubercula quadrigemi

Upper Surface – Anteriorly it forms part of floor of lateral ventricle, and presents a sli elevation, the anterior tubercle; posteriorly it is covered by fornix, which rests upo

Under Surface – Continuous with posterior rounded extremity. In its posterior part it fo roof of descending cornu of lateral ventricle, and presents two small eminences, *corpora geniculata internum et externum*, which are connected respectively with inne outer bands of origin of optic tract. In its anterior part it rests upon the crus cere and is penetrated by the radiating fibres above mention

Inner Surface – Forms lateral boundary of 3rd ventricle. Is joined to its fellow by the mid soft, or grey commissure, and presents inferiorly the grey matter of the interior of thalamus uncovered by the white. The superior peduncle of the pineal gland se rates this surface from the up

Outer Surface – Continuous anteriorly with posterior narrow extremity of corpus striat and embedded posteriorly in white substance of temporo-sphenoidal l

CHOROID PLEXUS — The thick, convoluted & fringe-like margin of the velum interpositu Vide Velum interposit

CORPUS FIMBRIATUM or TÆNIA HIPPOCAMPI — The thin lateral margin of posterior crus of the for

FORNIX — Triangular longitudinal lamella of white matter broad behind, narrow in front, situa below corpus callosum with which it is joined behind, and to which it is connected in fr by septum lucidum; forms roof of third & posterior part of floor of both lateral ventric Presen

Body – Presents:

Upper Surface – Joined behind with corpus callosum, and connected in front to the sa by septum lucidum; forms posterior part of floor of both lateral ventric

Under Surface – Marked posteriorly by a few transverse & anteriorly converging fib which form the *lyra*. Forms centrally the roof of 3rd ventricle; rests laterally u optic thalami. Is covered by velum interposit

Anterior Crura – Descend behind anterior white commissure & in front of optic thala forming anterior boundary of foramen of Monro, and perforate grey substance floor of 3rd ventricle to corpora albicantia, in which they twist upon themselves; t then ascend to corresponding optic thala

Posterior Crura – Diverge into the descending cornua of lateral ventricles, becoming continu with inner border of hippocampus major. Their thin lateral margin is the *corpus* *briatum* or *tænia hippoca*

ARTS SEEN in DESCENDING CORNU of LATERAL VENTRICLE.

HIPPOCAMPUS MAJOR or CORNU AMMONIS – Is a white eminence which curves downwards, forwards, & inwards along floor of descending cornu of lateral ventricle, and which corresponds to the dentate fissure & to the reflected portion of the convolution of the corpus callosum or gyrus fornicatus, which portion has been described of late years as the anterior part of the *gyrus uncinatus*. It enlarges anteriorly, and ends in the

PES HIPPOCAMPI – The anterior rounded extremity of the hippocampus major; it more or less resembles the paw of an animal, being marked along its margin by slight notches or depressions separating rounded intervening elevations.

PES ACCESSORIUS or EMINENTIA COLLATERALIS – A small rounded eminence, simlar to the preceding, situated between the two hippocampi at junction of middle & posterior cornua. It corresponds to the collateral fissure.

CORPUS FIMBRIATUM or TÆNIA HIPPOCAMPI – The prolongation of the thin lateral margin of the posterior crus of the fornix; is continuous with inner border of hippocampus major.

CHOROID PLEXUS – Vide next Tablet.

FASCIA DENTATA – The grey serrated border of the dentate convolution, which is separated from the gyrus uncinatus by the dentate fissure of Huxley. It lies beneath the corpus fimbriatum & the margin of the choroid plexus.

TRANSVERSE FISSURE – Vide next Tablet.

A.

TRANSVERSE FISSURE of the BRAIN and INTRA CEREBRAL PORTION of the PIA MATEI

TRANSVERSE FISSURE OF THE BRAIN

Is of a horse-shoe shape, and about 3 inches wide.

Its central part is horizontal and comprised between the tubercula quadrigemina the posterior extremity or splenium of the corpus callosu

Its lateral portions curve downwards & forwards, and are comprised between t optic thalami & crura cerebri below & in front and the hippocampi majores corpora fimbriata above & behir

This fissure transmits the pia mater into the interior of the brain.

INTRA-CEREBRAL PORTION OF THE PIA MATER

Forms on the one hand the velum interpositum & the choroid plexuses of the late & the 3rd ventricles, and, on the other, the choroid plexuses of the 4th ventric

Velum Interpositum – Is a triangular fold of pia mater which is reflected into t interior of the brain through the transverse fissure. It presen

Central Portion – Invests pineal gland, and covers under surface of fornix. Fr the under surface of this central portion two small vascular fringes, t choroid plexuses of the 3rd ventricle, hang down into the latter cavi

Lateral Margins – Spread out on either side beneath the corresponding margin the fornix & its continuation, the corpus fimbriatum, into the body & d cending cornu of the corresponding lateral ventricle, resting, as do margins of the fornix, upon the optic thalami. These lateral margins thick, convoluted & fringe-like; they constitute the choroid plexuses of lateral ventricles further described bel

Posterior Margin or Base – Is turned backwards towards the transverse fiss It is continuous with the general pia mater; it receives the anterior posterior choroid arteries and emits the venæ Gal

Anterior Bifid Extremity – Continuous through the foramina of Monro with anterior pointed extremities of the lateral margins above described choroid plexuses of the lateral ventric

Choroid Plexuses of the Lateral Ventricles – Are nothing more than the thi convoluted & fringe-like margins of the velum interpositum. When they described separately, that is to say irrespectively of the velum interposit of which they are a portion, they may be said to penetrate into the desce ing cornua of the lateral ventricle through the lateral portions of transverse fissure. Hence they ascend into the body of the lateral ven cle along the side of the corpus fimbriatum, winding round the poste extremity of the optic thalamus. Then continuing along the side of fornix, they taper to a point, and passing through the corresponding fo men of Monro, they join with each other and with the anterior bifurca extremity of the central & thinner portion of the velum interposit

Choroid Plexuses of the 3rd Ventricle – Are two small vascular fringes wh hang down from the under surface of the central portion of the vel interpositum into the cavity of the 3rd ventricle; they diverge sligh behi

Choroid Plexuses of the 4th Ventricle – Are two similar fringes which proj into the 4th ventricle from the layer of pia mater which closes that ven cle inferiorly; they pass upwards & outwards from near the point of inferior vermiform process to the outer margin of the restiform bo

THE THIRD VENTRICLE

Is a narrow median fissure comprised between the optic thalami, and extending to the base of the brain. It presents:

Roof – Formed by under surface of fornix and by velum interpositum.

Floor – Corresponds to interpeduncular space on under surface of cerebrum, and is formed from before backwards by the lamina cinerea, tuber cinereum & infundibulum, corpora albicantia and locus perforatus posticus. It is oblique downwards & forwards, and is covered by a thick layer of grey matter. It presents in the fœtus the opening of the iter ad infundibulum.

Lateral Walls – Formed by inner surface of optic thalami, which surface is bounded above by superior peduncles of pineal gland, and is covered below by part of the grey matter of the third ventricle prolonged upwards from its floor. – The lateral walls are joined together by the middle or soft commissure, a transverse band of grey matter continuous with the remainder of the grey matter of the 3rd ventricle.

Ant. Extremity – Formed by anterior crura of fornix. In front of these is the anterior commissure, a transverse band of white fibres, which perforates laterally the corpora striata & spreads out into the substance of both hemispheres. – Between the crura & the optic thalami are the foramina of Monro, through which the lateral & 3rd ventricles communicate, and the anterior extremities of the velum interpositum pass from the 3rd into the lateral ventricles to form the choroid plexuses of the latter.

Post. Extremity – Formed by posterior commissure, a transverse band of white fibres connecting posteriorly the optic thalami. Below this is the opening of the iter a tertio ad quartum ventriculum, and above are the tubercula quadrigemina & the pineal gland.

For parts above mentioned see foregoing Tablets.

STRUCTURE of the CEREBRUM — 1st Tablet.

WHITE FIBRES — Are peduncular & commissural.

PEDUNCULAR OR DIVERGING FIBRES — Present for examination their origin their course & their termination

Their Origin. – They are derived from the five following sources, viz.:

Crura Cerebri,
Superior Peduncles of the Cerebellum,
Tubercula Quadrigemina,
Corpora Geniculata Internum & Externum,
Corpora Striata & Optic Thalami.

Fibres from the Crura Cerebri – The most numerous. They form two sets respectively derived from the inferior or fasciculated portion of the crus, & fron its upper portion or tegmentum. The fibres from the inferior or fasciculate portion of the crus are the continuation of the fibres of the anterior pyramids The fibres from the upper portion or tegmentum are the continuation of th fasciculus teres & of the antero-internal division of the olivary fasciculus o fillet; the fasciculus teres being itself derived (Vide structure of the mesocephalon) on the one hand, from the middle set of fibres of the lateral trac of the medulla, and on the other hand, from the fasciculus gracilis or inne set of fibres of the posterior column of the cord

Fibres from the Superior Peduncles of the Cerebellum – Arise, as it ha already been stated, in the laminæ of the inferior vermiform process and als in the interior of the corpus dentatum. These fibres join the upper part o tegmentum of the crus cerebri

On a plane posterior & superior to that of the two foregoing sets of fibre lie the fibres derived from th

Tubercula Quadrigemina and from the
Corpora Geniculata Internum & Externum. – The fibres derived from the
Corpora Striata & Optic Thalami are added in these bodies to the fibres derived from the cru

Their Course – Is through the corpora striata & optic thalami as follows: –

Fibres of the Fasciculated Portion of the Crus Cerebri – Perforate the corpu striatum forming the pecten or corona radiata of Reil, and dividing th corpus striatum into intra- & extra-ventricular portion

Fibres of the Tegmentum & of the Superior Peduncles of the Cerebellu and Fibres derived from the Tubercula Quadrigemina & the Corpor Geniculata – Perforate the optic thalami in a similar manner.

Their Termination. – In the cerebrum they radiate towards the convolutions, decussating with the fibres of the corpus callosum, and forming a kind of hollo cone curved outwards & downward

COMMISSURAL FIBRES — Are of three kinds, transverse, antero-posterior, & gyral.

Transverse – Form three sets as follows. Those belonging to the

Corpus Callosum – Pass laterally into the substance of both hemispheres, an radiate towards the convolutions, decussating with the peduncular fibre

Anterior Commissure – Perforate the corpora striata, and then bend backward for some distance in the substance of the hemisphere

Posterior Commissure – Perforate the optic thalami, and are similarly lost i the hemisphere

Antero-Posterior – Form the following parts:

Tænia Semicircularis,
Fornix with its Anterior & Posterior Crura,
Peduncles of the Pineal Gland,
So-called "Nerves" of Lancisi with the Striæ Longitudinales Laterales, & t longitudinal fibres on the under surface of the corpus callosum (Vide a these parts in respective Tablets

Gyral – Vide grey matter of the cortical substance. – One set of these gyral fibre those of the gyrus fornicatus & of its continuation, the gyrus uncinatus, ma be placed among the antero-posterior commissural fibres; they form a almost complete circle extending round the corpus callosum from the fro to the back of the anterior perforated space (Foville

STRUCTURE of the CEREBRUM — 2nd Tablet.

GREY MATTER.

Grey Matter of the Cortical Substance — The cortical substance consists, not of grey or vesicular matter alone, but of vesicular matter and white fibres, arranged in alternate strata four in number over the greater part of the cerebrum, six in number in the vicinity of the corpus callosum. Thus on a vertical section we find from without inwards over the greater part of the cerebrum: – 1. *A thin layer of white matter* most marked over the under & inner surfaces of the hemispheres, especially over the internal temporo-sphenoidal convolutions. – 2. *A relatively thick layer of grey matter.* – 3. *A thin layer of white matter.* – 4. *A thin layer of grey matter*, which latter lies in contact with the central white substance. In the vicinity of the corpus callosum an additional white layer divides the superficial grey layer into two, making six layers altogether.

The cells of the grey matter are of variable size, some of the smallest belonging, it is believed, not to the nervous substance, but to the connective tissue. They contain a nucleus, a nucleolus & granular material, give off caudate prolongations, and lie in a granular matrix. Those of the innermost layer often contain a little pigmentary matter. There are also among them some free nuclei or nucleus-like bodies.

The white fibres, though mainly collected into the two or three white layers above mentioned, also pervade to some extent the whole of the cortical substance. They run parallel to the surface, intersecting each other in every direction, and being intersected in their turn by the radiating peduncular fibres. They connect, some of them adjoining, others more or less distant gyri, and may therefore be termed the *gyral fibres ;* but their precise mode of origin & termination, as well as that of the peduncular fibres, is still unknown. – One set of these gyral fibres, those of the gyrus fornicatus & of its continuation, the gyrus uncinatus, may be placed among the antero-posterior commissural fibres; they form an almost complete circle extending round the corpus callosum from the front to the back of the anterior perforated space (Foville).

Grey Matter of the Base & Interior of the Brain – Forms a series of continuous deposits, some superficial,— lamina cinerea, tuber cinereum, grey matter of the anterior & posterior perforated spaces,— some deeply situated,— optic thalami, corpora geniculata, corpora striata, tubercula quadrigemina. The superficial deposits, and also the grey commissure & the pineal gland, connect the deeper masses from one side of the cerebrum to the other. – For the arrangement of the grey matter in each of these parts vide respective Tablets.

GREY MATTER of the CEREBELLUM.

(DR. GOWERS' NEW DESCRIPTION.)

The description of the Grey Matter of the Cerebellum given by Dr. Gowers in the 8 edition of Quain's Anatomy differs from the hitherto received descriptions mainly in tw points, namely, the greater importance given to the nuclei or granules, and the better de cription of the large pellucid cells, or cells of Purkinje. These cells form a separate distinct layer between the inner & outer parts of the grey matter, which grey matter ma therefore be divided into three layers, as follows : –

Middle Layer – Cells of Purkinje – These are large cells, varying from $\frac{1}{800}$ to $\frac{1}{10}$ of an inch in diameter, most abundant towards the apices of the lamellæ, main flask-shaped, and disposed perpendicularly to the surface. They present a lar oval nucleolated nucleus.

They give off *two sets of processes*, the inner ones, & the outer ones.

The *inner processes* are short, delicate, & non-ramified. They dip into the inn or granule layer, and are probably continuous with the axis-cylinders of fibres the white substance.

The *outer processes* are larger, granular or finely striated, & ramified. Some their ramifications are connected with the angular corpuscles, or caudate ner cells of the outer layer. Most of them appear however to be lost near the surfa of the organ. Some are said to turn backwards and to end on the granule lay possibly by joining with the radiating fibres of the white substance.

Outer Layer – Is of a clear grey colour. It contains granule-like bodies of various siz the smaller of which are connective tissue corpuscles connected with a network connective tissue fibres. Others, larger, are caudate nucleated cells connecte with the outer processes of the cells of Purkinje. Some appear to be similar the granules of the inner, or granule layer.

These bodies lie in the midst of numerous fibres, most of which pass outwar towards the surface of the organ. Some of these fibres are connective tissue fibre as above stated; and these are joined by a broad basis to the pia-matral coverin Others are the outer processes of the cells of Purkinje. Near these cells of Pu kinje are a few nerve fibres, which run parallel to the surface.

Inner, or Granule Layer – Is of a reddish grey colour. It presents dense groups granule-like bodies, embedded in a gelatinous matrix, and varying in diamet from $\frac{1}{2500}$ to $\frac{1}{4000}$ of an inch ; the larger granules being somewhat less dense scattered round the cells of Purkinje.

The granule layer also presents a fine flexus of nerve fibres running betwee the granules, and a few caudate nucleated cells with which these fibres are probabl connected. A few granules are met with in the outer portions of the central whit substance.

(Dr. Gower's description is partly based upon the investigations of Mr. H. O. Sankey of University College.)

CRANIAL NERVES.

NOTE – The Modern Views regarding the Deep Origins of the 5th, 6th, 7th, 8th, & 9th Cranial Nerves are given on page 213, with the description of the Grey Matter of the Medulla. – See also note on page 250.

SECOND or OPTIC NERVE

Presents for examination the optic tract, the optic commissure & the optic nerve proper.

OPTIC TRACT

Begins in the *anterior & posterior quadrigeminal bodies* by two distinct bundles of fibres, which pass between the *corpora geniculata internum et externum*, become respectively connected with and receive fibres from the latter, unite, and receive additional fibres from the *optic thalamus.*

Winds obliquely forwards across under surface of crus cerebri, being flattened in shape and slightly attached to the crus by its anterior margin.

Leaves the crus as a round bundle and becomes connected with the *lamina cinerea & the tuber cinereum*, from both of which it is said to receive additional fibres.

Joins its fellow to form optic commissure.

OPTIC COMMISSURE or CHIASMA

Is formed as follows:

A few of the outer fibres of each optic tract pass into the optic nerve of the same side.

The mass of the fibres decussate, and pass into the optic nerve of the opposite side.

A few of the innermost fibres, termed the inter-cerebral fibres, pass back to the cerebrum, forming the posterior fibres of the commissure and the innermost fibres of the optic tract of the opposite side.

A few similar fibres, termed the inter-retinal fibres, pass along the anterior border of the commissure from one optic nerve to the other.

OPTIC NERVE

Through optic foramen, being surrounded by a tubular process of the dura mater, which, as the nerve enters the orbit, subdivides, and both continues the sheath of the optic nerve, and forms the periosteum of the orbit.

Pierces sclerotic and choroid about one tenth of an inch to the inner side of the axis of the eye, and expands into the retina. – The arteria centralis retinæ pierces the optic nerve, and runs forwards in its substance to the retina.

FIRST or OLFACTORY NERVE

Arises by three roots.

THE THREE ROOTS — Are the:

External or Long Root — Arises from the *posterior border of the fissure of Sylvius*, and is said to be traceable to the corpus striatum, the anterior commissure, the thalamus opticus & the Island of Reil.

It passes forwards and inwards along the anterior margin of the locus perforatus anticus.

Internal or Short Root — Arises from the *posterior and inner part of the anterior lobe*, and is said by Foville to be connected with the longitudinal fibres of the gyrus fornicatus or convolution of the corpus callosum.

It passes forwards & outwards, and joins the foregoing root just above the origin of the middle or grey root.

Middle or Grey Root — Begins in a pyramidal eminence, the *caruncula mammillaris*, of the grey matter of the posterior part of the anterior lobe, and is continued upon the upper surface of the nerve with a few white fibres derived from the corpus striatum.

The three roots coalesce and form a prismoid band, the

OLFACTORY PROCESS, — which passes forwards in a deep sulcus along the side of longitudinal fissure, and expands into the

OLFACTORY BULB, — from the under surface of which are given off about twenty

TERMINAL BRS., — which pass through the foramina in the cribriform plate of the ethmoid, and — forming *three sets* distributed respectively over the *roof of the nose*, over the *upper third of the septum*, and over the *superior & middle turbinated bones* — proceed between the fibrous & mucous layers of the Schneiderian membrane, ramify and unite and form a plexus with narrow elongated meshes, and probably terminate in the deep processes of the olfactory cells of Schultze.

These latter cells are spindle-shaped nucleated bodies, which stand vertically in great numbers among the columnar epithelial cells of the olfactory region; their extremities are continued into two thread-like processes, one of which terminates abruptly on a level with the free extremities of the epithelial cells, while the other passes downwards towards the attached surface of the mucous membrane.

The olfactory nerve contains a *large proportion of the grey matter*, and is soft and pulpy. Its filaments are deficient in the white substance of Schwann, and are granular and nucleated like the gelatinous nerve-fibres of Remak.

NERVES of the ORBIT

Are the:

SECOND or OPTIC N. — Vide foregoing Tablet.

THIRD N. or MOTOR OCULI

Arises from inner border of crus cerebri immediately in front of pons Varolii. — Deep origin is from locus niger & grey nucleus on floor of aqueduct of Sylvius below tubercula quadrigemina.

Pierces dura mater on outer side of and a little behind, anterior clinoid process.

Through outer wall of cavernous sinus above 4th nerve & ophthalmic branch of 5th, being joined by filaments from cavernous plexus.

Divides into superior & inferior branches, which pass through sphenoidal fissure between the two heads of external rectus.

SUPERIOR BR. – The smallest. Inwards above optic nerve to *levator palpebræ superioris* & *superior rectus.*

INFERIOR BR. – The largest. To *internal & inferior recti and inferior oblique.* — SHORT or MOTOR ROOT OF LENTICULAR GANGLION is derived from nerve to inferior oblique.

FOURTH N., TROCHLEARIS or PATHETICUS

Arises from upper part of *valve of Vieussens* immediately behind the testis. — Deep origin is from two grey nuclei situated on floor of aqueduct of Sylvius & on upper part of floor of 4th ventricle.

Crosses processus e cerebello ad testes and winds round under surface of crus cerebri immediately in front of pons Varolii.

Pierces dura mater in free border of tentorium cerebelli near posterior clinoid process.

Through outer wall of cavernous sinus below 3rd nerve and above ophthalmic branch of the 5th, receiving filaments from ophthalmic branch & from carotid plexus:

Through highest and broadest part of sphenoidal fissure.

Inwards above levator palpebræ superioris to orbital surface of superior oblique.

OPHTHALMIC BR. of the FIFTH N. — Vide Fifth Nerve.

ORBITAL BRS. of the SUP. MAXILLARY N. & of MECKEL'S G. — Vide Sup. Maxillary N, and Meckel's G.

SIXTH N. or ABDUCENS

Arises by several filaments from *constricted part of corpus pyramidale* close to pons Varolii or from *lower border of pons itself.* — Deep origin is from a grey nucleus on floor of 4th ventricle.

Pierces dura mater on basilar groove immediately below posterior clinoid process.

Forwards on floor of cavernous sinus on outer side of internal carotid artery, receiving filaments from carotid plexus, Meckel's ganglion & ophthalmic nerve.

Through sphenoidal fissure beneath the other nerves & above ophthalmic vein, receiving filaments from sympathetic.

Between the two heads of external rectus to ocular surface of that muscle.

RELATIONS of the NERVES of the ORBIT in

CAVERNOUS SINUS

Third & Fourth Ns. & Ophthalmic br. of Fifth — Pass through outer wall of cavernous sinus in their numerical order both from above downwards and from within outwards.

Sixth N. — Lies on floor of cavernous sinus on outer side of internal carotid artery, on inner side of ophthalmic nerve.

SPHENOIDAL FISSURE:

Fourth N., Frontal & Lachrymal Divisions of Ophthalmic N. — Enter orbit above external rectus.

The other Ns. — Pass between the two heads of external rectus in following order from above downwards: *Superior division of* 3*rd N., Nasal branch of Ophthalmic, Lower division of* 3*rd N., Sixth Nerve.*

ORBIT:

Fourth N., Frontal & Lachrymal Divisions of Ophthalmic N. — Lie above the muscles immediately beneath periosteum

The other Ns. — Are found in the following order from above downwards: *Superior division of* 3*rd N., Nasal branch of Ophthalmic* crossing optic N., *Optic N.*, having lenticular ganglion on its outer side, *Inferior division of the* 3*rd N., Sixth Nerve.*

FIFTH NERVE

Arises by two roots, anterior small or motor, posterior large or sensory, from *side of pons Varolii nearer to upper than to lower border.* Its deep origin is said to be from lateral tract of medulla behind olivary body, from grey nucleus on floor of 4th ventricle between restiform body & fasciculi teretes, from tubercle of Rolando; its motor root appears to arise from external angle of floor of fourth ventricle (See pages 213 & 250).

Through opening in dura mater near apex of petrous portion of temporal bone. Sensory root to Gasserian ganglion; motor root to inferior maxillary nerve outside cranium.

Gasserian ganglion - Crescentic. Situated in a depression near apex of petrous portion of temporal bone, and receives filaments from carotid plex. Gives off anteriorly ophthalmic, superior & inferior maxillary nerves, and laterally, small branches to tentorium cerebelli & dura mater of middle fossa, and one to 6th nerve in cavernous sinus.

OPHTHALMIC NERVE — The smallest of the three divisions of the 5th pair.

Through outer wall of cavernous sinus below 3rd & 4th nerves, being joined by filaments from cavernous plexus and frequently from 4th nerve, and giving off recurrent branches to tentorium.

Divides near sphenoidal fissure into lachrymal, frontal, nasal.

LACHRYMAL N. — The smallest.

Through outer & narrowest part of sphenoidal fissure, and along upper border of external rectus to lachrymal gland, conjunctiva & skin of upper eyelid. — Joins with orbital branch of superior maxillary nerve.

FRONTAL N. — The largest.

Through highest & broadest part of sphenoidal fissure;

Along middle line of orbit between levator palpebræ superioris & periosteum, and divides into:

SUPRAORBITAL BR. — The largest. Through supraorbital foramen or notch, and ascends to corrugator supercilii, occipito-frontalis & orbicularis palpebrarum, and to periosteum & integument, the cutaneous branches, two in number, lying at first beneath the muscles.

SUPRATROCHLEAR BR. — The smallest. Above pulley of superior oblique, and same distribution Joins with infratrochlear branch of nasal.

NASAL N. — Intermediate in size between the two others.

Between the two heads of external rectus, and forwards & inwards across optic nerve.

Through anterior ethmoidal foramen, and through groove on cribriform plate & slit by crista galli to nose, where divides into

INTERNAL BR. — To mucous membrane of fore part of septum;

EXTERNAL BR. — In groove on inner surface of nasal bone, between that bone & lateral cartilage, and downwards to tip of nose beneath compressor nasi supplying mucous membrane & integument.

Gives off:

GANGLIONIC BR. — Long & slender; to posterior superior angle of ciliary ganglion, forming its long or sensory root.

LONG CILIARY NS. — Two or three; join ciliary nerves from ciliary ganglion. (Vide Ciliary Ganglion).

INFRATROCHLEAR BR. — Beneath pulley of superior oblique, where joins with supratrochlear branch of frontal, to orbicularis, lachrymal sac, caruncula, conjunctiva & skin of eyelids.

CILIARY, OPHTHALMIC or LENTICULAR GANGLION.

Reddish grey quadrangular body of the size of a pin's head situated at back of orbit on outer side of optic nerve. — Presents:

THREE ROOTS:

Sensory, or Long & Slender Root — From *nasal branch of ophthalmic* to posterior superior angle of ganglion; is accompanied by the sympathetic root, which is sometimes blended with it.

Motor, or Short & Thick Root — From *branch of 3rd nerve to inferior oblique* to posterior inferior angle; is occasionally divided into two parts.

Sympathetic Root — Long & slender filament from *cavernous plexus;* accompanies sensory root, with which it is sometimes blended.

BRS. OF DISTRIBUTION:

Ciliary Ns. — Ten or twelve from anterior angles of ganglion, forming a small superior & a large inferior bundle;

Forwards above & below optic nerve with ciliary branches of nasal;

Through back part of sclerotic, and in grooves on its inner surface to ciliary muscle, cornea & iris.

SUPERIOR MAXILLARY NERVE.

Intermediate in size between ophthalmic & inferior maxillary nerves. – Commences at middle of Gasserian ganglion

Through foramen rotundum, spheno-maxillary fossa & infraorbital canal to infraorbital foramen, and divides beneath levator labii superioris into *palpebral, nasal & labial branches,* which branches anastomose with facial nerve forming infraorbital plexus and supply muscles, skin & mucous membrane.

BRANCHES:

Orbital or Temporo-malar Br. – Into orbit through spheno-maxillary fissure, and divides into:

TEMPORAL BR. – In groove & through foramen in malar bone, joining with lachrymal;

Pierces temporal muscle & fascia to skin of temple, and joins with facial & auriculo-temporal.

MALAR BR. – Through foramen in malar bone to skin of prominent part of cheek.

Spheno-palatine Brs. – Two. To Meckel's ganglion, of which they form the sensory root.

Post. Dental Brs. – Two:

ANTERIOR OR SUPERFICIAL – Over maxillary tuberosity to gums & buccinator.

POSTERIOR OR DEEP – Forwards in outer wall of Antrum, joining anterior dental nerve, and supplies molar & second bicuspid teeth & mucous membrane of Antrum.

Ant. Dental Br. – Arises just before exit of superior maxillary nerve from infra-orbital canal.

Downwards & forwards in anterior wall of Antrum joining with posterior dental nerve, and supplies incisor, canine & first bicuspid teeth and mucous membrane of inferior meatus. A twig joins superior nasal branch of Meckel's ganglion above eye-tooth, and presents a small ganglion, the ganglion of Bochdalek.

SPHENO-PALATINE or MECKEL'S GANGLION.

Triangular, of a reddish grey colour and situated in spheno-maxillary fossa near spheno-palatine foramen, mainly behind spheno-palatine branches of superior maxillary nerve, the fibres of these branches not being, or being but partly, involved in the ganglion as they descend to the nose & palate. Presents:

THREE ROOTS:

Sensory Root — From superior maxillary nerve through its two spheno-palatine branches.

Motor Root — From facial nerve through Vidian nerve.

Sympathetic Root — From carotid plexus also through Vidian nerve.

BRS. OF DISTRIBUTION — Are divided into:

Ascending Brs. — Two or three small filaments, which pass up through spheno-maxillary fissure to periosteum of orbit.

Descending Brs. — Are the:

ANT. OR GREAT PALATINE N. – Through great posterior palatine canal, giving off inferior nasal branches to middle meatus & to middle & inferior turbinated bones, and a twig to soft palate; Forwards in groove on hard palate, and joins termination of naso-palatine nerve.

EXT. PALATINE N. – Through external palatine canal to tonsil & soft palate. Is sometimes wanting.

POST. OR SMALL PALATINE N. – Through small posterior palatine canal to tonsil, soft palate and levator palati & azygos uvulæ.

Internal Brs. — Are the:

SUP. NASAL BR. – Small. Through spheno-palatine foramen to mucous membrane of superior & middle spongy bones & upper & back part of septum. A twig joins anterior dental nerve in outer wall of antrum of Highmore above eye-tooth & presents a small ganglion, the ganglion of Bochdalek.

NASO-PALATINE BR. – Through spheno-palatine foramen & across roof of nose to septum, and downwards to anterior palatine foramen. Through central division of the anterior palatine foramen, or foramen of Scarpa, right nerve being posterior to left one. Joins its fellow in common anterior palatine canal and ends in mucous membrane of hard palate, joining with anterior or great palatine nerve.

Posterior Brs. — Are the:

VIDIAN N. – Backwards through Vidian canal (if the nerve be traced from Meckel's ganglion), giving twigs to back of roof & septum of nose and to termination of Eustachian tube, and divides into:

Large Petrosal N. – Through cartilaginous substance of foramen lacerum medium, and then in groove on anterior surface of petrous portion of temporal bone beneath Gasserian ganglion & through hiatus Fallopii to geniculate ganglion or intumescentia gangliformis of facial.

Carotid Br. – Soft and of reddish grey colour. Through cartilaginous substance to carotid plexus on outer side of internal carotid artery.

PHARYNGEAL OR PTERYGO-PALATINE N. – Small. Through pterygo-palatine canal to mucous membrane of upper part of pharynx.

INFERIOR MAXILLARY NERVE.

The largest of the three divisions. Both sensory & motor, its two roots uniting immediately after their exit from foramen ovale.

Divides a few lines below base of skull into:

ANTERIOR or SMALLER DIVISION — Principally motor. Divides into:

Masseteric Br. – Outwards above external pterygoid muscle and through sigmoid notch to masseter. Gives off a twig to temporo-maxillary articulation & sometimes one to temporal muscle.

Deep Temporal Brs. – Two, anterior & posterior. Outwards above external pterygoid muscle and reflected upwards at pterygoid ridge to temporal muscle. Are sometimes joined, anterior one with buccal nerve, posterior one with masseteric.

Buccal Br. – Pierces external pterygoid, and forwards on buccinator, giving filaments to temporal muscle, integument & mucous membrane.

Pterygoid Brs. – Two, to internal & external pterygoid muscles. Branch to internal pterygoid gives off motor root to otic ganglion. Branch to external pterygoid is frequently derived from buccal.

POSTERIOR or LARGER DIVISION — Sensory with a few motor fibres. Divides into:

Auriculo-temporal N. – Has generally two roots which embrace middle meningeal artery. Backwards beneath external pterygoid & neck of condyle; Upwards with temporal artery between condyle & external ear under cover of parotid gland, and divides into:

AURICULAR BRS. – Inferior & superior, to outer surface of pinna, joining with great auricular.

TEMPORAL BRS. – Anterior & posterior; with branches of temporal artery to skin of temporal region & vertex.

Joins facial nerve behind neck of condyle usually by two branches; gives off sensory root of otic ganglion and filaments to parotid gland & temporo-maxillary articulation.

Gustatory or Lingual N. – Between the two pterygoid muscles, where it lies on inner side & in front of inferior dental nerve, and is joined by chorda tympani; Above deep portion of submaxillary gland & along side of tongue, crossing Wharton's duct.

Supplies mucous membrane of mouth & gums, submucous glands, conical & fungiform papillæ and mucous membrane of tongue.

Gives sensory branches to submaxillary ganglion, and anastomoses with hypoglossal nerve on anterior margin of hyo-glossus & near tip of tongue.

Inf. Dental N. – Between the two pterygoid muscles, where lies behind & on outer side of gustatory;

Between ramus & internal lateral ligament of temporo-maxillary articulation to dental foramen, where gives off nerve to mylo-hyoid muscle.

Along inferior dental canal, giving branches to molar & bicuspid teeth, & divides at mental foramen into:

INCISOR BR. – Onwards in dental canal to canine & incisor teeth.

MENTAL BR. – Divides beneath depressor anguli oris into numerous branches to muscles, skin & mucous membrane of lower lip.

NERVE TO MYLO-HYOID – Along groove on inner surface of ramus to under surface of mylo-hyoid & anterior belly of digastric

N.—All the terminal branches of the 5th nerve upon the face. join with facial nerve.

OTIC GANGLION

Small oval shaped flattened body of a reddish grey colour situated on inner surface of inferior maxillary nerve & around origin of its internal pterygoid branch, just below foramen ovale, close to tensor tympani muscle & cartilaginous portion of Eustachian tube which lie on its inner side, and to middle meningeal artery which lies behind. It presents:

THREE ROOTS:

Sensory Root - From auriculo-temporal nerve, and also from glosso-pharyngeal through small petrosal nerve.

Motor Root - From inferior maxillary nerve & its internal pterygoid branch; also from facial nerve through small petrosal.

Sympathetic Root - From plexus on middle meningeal artery.

BRS. OF DISTRIBUTION — Small branches to tensor palati & tensor tympani.

SUBMAXILLARY GANGLION

Reddish grey circular body about the size of a pin's head situated between gustatory nerve & deep portion of submaxillary gland. It presents:

THREE ROOTS:

Sensory Root - From gustatory nerve by several small filaments.

Motor Root - From facial nerve through chorda tympani.

Sympathetic Root - From plexus around facial artery.

BRS. OF DISTRIBUTION — Five or six to mucous membrane of mouth, Wharton's duct & submaxillary gland.

FACIAL N. or PORTIO DURA of the 7th PAIR.

Arises from *upper part of lateral tract of medulla oblongata in groove between olivary & restifor bodies.* — Its deep origin is from a grey nucleus on floor of 4th ventricle & from nucleu of motor root of 5th nerve, and also, by its accessory portion or portio intermedia Wrisberg, from lateral column of cor

Through internal auditory meatus with portio mollis, lying in a groove upon the latter an portio intermedia of Wrisberg lying between the tw

Through aqueductus Fallopii, in which runs outwards, backwards, downwards:

Outwards – between cochlea and vestibule to hiatus Fallopii, where present geniculate ganglion or intumescentia gangliformi

Backwards – in inner wall of tympanum above fenestra ovalis.

Downwards – to stylo-mastoid foramen.

Forwards in substance of parotid gland crossing external carotid artery, and divides behin ramus of jaw into temporo-facial & cervico-facial branches, forming pes anserinu

Its branches may be divided into branches of communication & branches of distribution.

BRANCHES OF COMMUNICATION — Are:

In Meatus Auditorius Internus:

One or two filaments to Auditory N.

In Aqueductus Fallopii:

Large Petrosal N. – to Meckel's ganglion, and supplies *levator palati & azygos uvulæ*

Small Petrosal N. – to Otic ganglion, and supplies *tensor palati & tensor tympani*

Ext. Petrosal N. – to sympathetic on middle meningeal artery.

After Exit from Stylo-mastoid Foramen:

Branches to: Glosso-pharyngeal, Pneumogastric & Carotid Plexus – Arise fro posterior auricular nerve & from nerves to stylo-hyoid & posterio belly of digastri

Auriculo-temporal – From temporo-facial branch.

Great Auricular – From posterior auricular & cervico-facial branches.

On the Face:

The terminal filaments join with the three divisions of the Fifth N.

BRANCHES OF DISTRIBUTION — Are:

In Aqueductus Fallopii:

TYMPANIC BR. – To *stapedius & laxator tympani;*

CHORDA TYMPANI – Enters tymp. between membr. tympani & base of pyramid
Between handle of malleus & long process of incus.
Through canal of Huguier on inner side of Glaserian fissure;
Joins gustatory nerve between the two pterygoid muscles;
To submaxillary ganglion & lingualis superior.

After Exit from Stylo-mastoid Foramen:

POST. AURICULAR N. – Over mastoid process to integument and retrahens aure & posterior belly of occipito-frontalis, and anastomoses with auricularis magnus & posterior auricular branch of pneumogastri

BRS. TO STYLO-HYOID & POST. BELLY OF DIGASTRIC – Arise in common, an join, the former with carotid plexus, the latter with glosso-pharyngea

On the Face:

TEMPORO-FACIAL BR. – The larger. Anastomoses with auriculo-temporal, an divides into *temporal, malar & infraorbital branche*

CERVICO-FACIAL – The smaller. Anastomoses with great auricular, and divide into *buccal, supramaxillary & inframaxillary branch*

These terminal branches of the facial nerve supply all the muscles expression of the face & the platysma, and anastomose with th ophthalmic, superior & inferior maxillary nerves and with th great auricula

AUDITORY N. or PORTIO MOLLIS of the 7th PAIR.

Arises from the *floor of the 4th ventricle*, its fibres of origin forming the *lineæ transversæ*.

Outwards behind the *restiform body* and forwards below the lower border of the *pons*, receiving filaments from the former and perhaps also from the latter. Is also said by Foville to be connected with the *flocculus* and with the *grey matter of the cerebellum*.

Enters the internal auditory meatus with the facial nerve, which lies in a groove upon its surface, the portio intermedia of Wrisberg lying between the two. The two nerves are connected within the meatus by one or two filaments.

Divides into two branches, the vestibular & the cochlear nerves.

VESTIBULAR NERVE

Divides into three branches, the subdivisions of which pass through the small openings at the upper & back part of the cul-de-sac at the bottom of the internal auditory meatus, and are distributed to the utricule, the saccule & the ampullæ opposite the masses of otoconia.

COCHLEAR NERVE

Divides into numerous filaments, which pass through the small openings at the base of the modiolus, and through the minute canals in its axis. These filaments bend outwards between the plates of the osseous zone of the lamina spiralis, forming a plexus in which ganglion-cells are found; branches from this plexus perforate the lower edge of the osseous zone, forming radiating bundles comprised partly within the osseous and partly within the membranous zone. The terminal filaments are believed to be connected with the spindle-shaped cells of the organ of Corti. (Vide Minute structures of the Cochlea).

Note – From recent statements by Mr. Lockhart Clarke, the auditory nerve would appear to have another set of fibres in addition to those above described. These fibres would arise from the recently discovered External Auditory Nucleus (V. notes on pages 213 & 216) and they would pass outwards *through the substance of the restiform body* to join externally to that body with the bundle of fibres hitherto recognised.

GLOSSO-PHARYNGEAL NERVE.

The smallest of the three divisions of the 8th pair. *Arises from lateral tract of medulla oblongata above pneumogastric.* — Its deep origin is from a grey nucleus on floor of 4th ventricle.

Through anterior & inner part of jugular foramen in front of pneumogastric & spinal accessory and in a separate sheath, grooving lower border of petrous portion of temporal bone and presenting two ganglia:

Sup. or Jugular G. or G. of the Root — Small, and involves only the outer fibres;

Inf. of Petrous G. or G. of Andersch — Larger, and involves whole of fibres.

Gives off from petrous ganglion:

Tympanic branch or *Jacobson's nerve,* described below;

Anastomotic br. to *ganglion of the root & to auricular br. of the pneumogastric;*

and from a little below the ganglion:

Anastomotic br. to *facial nerve.* — This branch pierces post. belly of digastric.

Downwards & forwards in front of pneumogastric & between int. carotid & int. jugular vein.

Beneath styloid process & muscles connected with it to lower border of stylo-pharyngeus,

Curves inwards upon stylo-pharyngeus & middle constrictor.

Beneath hyo-glossus to mucous membrane of fauces & base of tongue.

BRANCHES:

Tympanic Br. or Jacobson's N. — Arises from petrous ganglion.

Ascends through small canal in petrous bone to tympanum, where divides into:

Brs. of Communication — To *carotid plexus and great & small petrosal branches of facial.*

Brs. of Distribution — To *fenestra rotunda, fenestra ovalis & mucous membrane of Eustachian tube.*

Carotid Brs. — Descend on internal carotid artery, and join pharyngeal brs. of pneumogastric, sup. laryngeal & sympathetic.

Pharyngeal Brs. — Three or four; form pharyngeal plexus by joining opposite middle constrictor with pharyngeal brs. of pneumogastric, sup. laryngeal & sympathetic.

Muscular Brs. — To stylo-pharyngeus & constrictors of pharynx.

Tonsillar Brs. — To tonsil, forming tonsillar plexus, branches of which are distributed to soft palate & fauces.

Lingual Brs. — To mucous membrane of base & side of tongue.

PNEUMOGASTRIC NERVE

Arises from lateral tract of medulla oblongata below glosso-pharyngeal & above spinal accessory. — Its deep origin is from a grey nucleus on floor of fourth ventricle.

Through jugular foramen behind glosso-pharyngeal & in same sheath as spinal accessory.

Presents two ganglia, one in and one below jugular foramen:

Sup. or Jugular G. or G. of the Root — Small, greyish, rounded. Anastom. with *facial, glosso-pharyngeal, spinal accessory & sympathetic.*

Inf. G. or G. of the Trunk — Reddish, cylindrical, nearly an inch in length. Anastom. with *hypoglossal, spinal accessory, sympathetic, loop between two first cervical nerves.*

Descends behind & between int. & comm. carotid arteries & int. jugular v. and in same sheath;

Then,

On Right Side:

Between subclavian art. & v. and along side of trachea to back of root of lung, where spreads out into posterior pulmonary plexus.

Along side of œsophagus in the shape of two or more separate cords, which form œsophageal plexus with nerve of opposite side.

As a single cord along back of œsophagus to posterior surface of stomach, and joins solar & splenic plexuses.

On Left Side:

Between and in front of left comm. carotid & left subclavian arteries behind left innominate vein.

Across arch of aorta to back of root of lung, where similarly spreads out and joins with its fellow.

Along side of œsophagus as above.

As a single cord along front of œsophagus to anterior surface of stomach, and joins left hepatic plexus.

BRANCHES:

Auricular Br. — Arises from g. of the root, and joins with glosso-pharyngeal.

Across jugular fossa & through opening in temporal bone near styloid process;

Between mastoid process & ext. audit. meatus to integument of back of pinna.

Gives off:

Ascending Br., which joins trunk of facial in aqueductus Fallopii;

Descending Br., which joins auricular branch of facial.

Pharyngeal Br. — Arises from upper part of ganglion of the trunk;

Crosses internal carotid art. either in front or behind;

Anast. with glosso-pharyngeal, sup. laryngeal & sympathetic, and forms pharyngeal plexus to muscles & mucous membrane of pharynx.

Sup. Laryngeal N. — Arises from middle of ganglion of the trunk.

Descends by side of pharynx behind int. carotid artery, and divides into:

EXT. LARYNGEAL BR. — Joins with pharyngeal plexus & sup. cardiac nerve, and supplies crico-thyroid & inf. constrictor.

INT. LARYNGEAL BR. — Pierces thyro-hyoid membrane to arytenoid muscle and mucous membrane of larynx, base of tongue & aryteno-epiglottidean folds.

Recurr. Laryngeal N. — Ar. in front of, and passes below & behind, subclav. art. on right side, arch of aorta, on left, giving twigs to deep cardiac plexus;

Behind comm. carotid & inf. thyroid arteries, and in groove between trachea & œsophagus.

Beneath inf. constrictor to all the muscles of the larynx except crico-thyroid.

Gives brs. to inf. constrictor, and anastomoses with ext. laryngeal

Cardiac Brs. — Divided into:

Cervical Cardiac } Vide Nerves of the Heart.
Thoracic Cardiac }

Pulmonary Brs. — Divided into Anterior and Posterior, and form the ant. & post. pulmonary plexuses. (Vide nerves of the lung.)

Œsophageal Brs. — Arise, some above, but most of them below, the pulmonary.

Gastric Brs. — Right pneumogastric supplies post. aspect of stomach and joins solar & splenic plexuses; left pneumog. supplies ant. aspect, and joins left hepatic plexus.

SPINAL ACCESSORY NERVE

Consists of two portions, the portion accessory to the pneumogastric & the spinal portion

PORTION ACCESSORY to the PNEUMOGASTRIC — The smaller.

Arises from *lateral tract of medulla oblongata below pneumogastric.* — Deep origin fro
grey nucleus on lower part of floor of 4th ventric

Joins ganglion of root of pneumogastric in jugular foramen by two or three filamen
and is entirely added to the pneumogastric below the ga
glion of the trur

Assists in forming *pharyngeal, superior & inferior laryngeal brs.* of pneumogastric.

SPINAL PORTION — The larger.

Arises from *lateral column of cord as low as 5th or 6th cervical n.* — Deep origin fr
anterior horn of grey matt

Ascends between ligamentum denticulatum & posterior roots of the spinal ns., a
enters skull through foramen magnu

Passes out through jugular foramen in same sheath as, and on outer side of, pneun
gastric n. and behind glosso-pharyngeal, joining with acc
sory porti

Backwards behind hypoglossal & pneumogastric, beneath and then behind intern
jugular vein and digastric & stylo-hyoid muscles to up
part of sterno-masto

Pierces deep fibres of sterno-mastoid, giving branches to it and joining in its su
stance with 3rd cervical ner

Crosses posterior triangle of the neck, joining with 2nd, 3rd, 4th & 5th cervical
and is distributed to under surface of trapezi

HYPOGLOSSAL NERVE

Arises by ten or twelve filaments from *groove between anterior pyramid & olivary body* in a line continuous with that of the anterior roots of the spinal nerves. These filaments form two bundles which perforate dura mater separately, and pass together through anterior condyloid foramen. — Its deep origin is from a grey nucleus on lower part of floor of 4th ventricle.

Passes downwards and forwards between pneumogastric & spinal accessory ns., with former of which it is intimately connected, and between int. jugular vein & int. carotid.

Loops round occipital artery and passes forwards across external carotid below post. belly of digastric.

Passes beneath posterior belly of digastric & stylo-hyoid and crosses hyo-glossus, near ant. border of which it anastomoses with gustatory.

Passes beneath mylo-hyoid to muscles & substance of the tongue.

BRS. OF COMMUNICATION — Join with:

G. of the trunk of the pneumogastric;
Sup. cervical g. of the sympathetic;
Loop between the two first cervical ns.
} Arise near base of skull.

Gustatory n. — Arises near ant. border of hyo-glossus.

BRS. OF DISTRIBUTION — Are the:

Descendens Noni — Long & slender. Arises just beneath occipital artery. Passes downwards & forwards across sheath of carotid vessels. (Sometimes within the sheath, either over or beneath int. jugular vein). Near middle of neck forms a loop with Communicans Noni, from convexity of which loop, brs. are given off to sterno-hyoid & -thyroid and omo-hyoid.

This br. is believed to derive its real origin principally from the 1st & 2nd cervical ns., and to have little more than an apparent origin from the hypoglossal, due to a temporary adhesion of its fibres to those of that nerve. Sometimes, owing to similar adhesions, it appears to arise from the pneumogastric either wholly or in part.

Brs. to Thyro-hyoid & Genio-hyoid — Arise on surface of hyo-glossus.

Brs. to Stylo-glossus, Hyo-glossus, Genio-hyo-glossus & substance of the tongue. — Arise beneath mylo-hyoid.

TABLEAU of the CRANIAL NERVES.

First or Olfactory – Arises by three roots:
Ext. or Long Root – From *posterior border of fissure of Sylvius.*
Int. or Short Root – From *posterior & inner part of anterior lobe.*
Middle or Grey Root – From *caruncula mammillaris.* – Presents olfactory process, olfactory bulb, terminal branches.

Second or Optic – From *anterior & posterior quadrigeminal* and *internal & external geniculate bodies,* and *optic thalamus.* – Presents optic tract, optic commissure or chiasma, & optic nerve proper.

Third or Motor Oculi – From *inner border of crus cerebri* just in front of Pons Varolii. – Supplies all the muscles of the orbit except superior oblique & external rectus, and gives off motor root to lenticular ganglion.

Fourth, Trochlearis or Patheticus – From *upper part of valve of Vieussens.* – Supplies superior oblique.

Fifth, Trigeminal or Trifacial – Vide next Tableau.

Sixth or Abducens – From *constricted part of corpus pyramidale* close to pons Varolii or from *lower border of pons itself.* – Supplies external rectus.

Facial or Portio dura of the 7th – From *upper part of lateral tract of medulla oblongata* in groove between olivary & restiform bodies.
Anastomoses – With *auditory, glosso-pharyngeal, pneumogastric, auriculo-temporal, great auricular;* – also large, small, & external petrosal nerves join *Meckel's & Arnold's ganglia & sympathetic.*
Branches – *Large, small, & external petrosal, tympanic, chorda tympani, posterior auricular, muscular* (to stylo-hyoid & posterior belly of digastric), *temporo- & cervico-facial.*

Auditory or Portio Mollis of the 7th – From *floor of 4th ventricle,* its fibres of origin forming the *lineæ transversæ,* and also from the restiform body & perhaps from pons Varolii. – Divides into *vestibular & cochlear nerves.*

Glosso-pharyngeal – From *lateral tract of medulla oblongata above pneumogastric.* Presents two ganglia in anterior or inner part of jugular foramen, the superior or jugular, and the inferior or petrous.
Anastomoses – With *pneumogastric* & *facial,* and through Jacobson's nerve with *carotid plexus and great & small petrosal nerves.*
Branches – *Tympanic, carotid, pharyngeal, muscular* (to stylo-pharyngeus & constrictors), *tonsillar, lingual.*

Pneumogastric – *From lateral tract of medulla oblongata below glosso-pharyngeal & above spinal accessory.* – Presents two ganglia,– superior or jugular, small, rounded, situated in jugular foramen,– inferior or petrosal, large, cylindrical, situated below the foramen.
Anastomoses – With *facial, the two other branches of the 8th, hypoglossal, sympathetic, loop between the two first cervical nerves.*
Branches – *Auricular, pharyngeal, superior laryngeal, inferior or recurrent laryngeal, cardiac, pulmonary, œsophageal & gastric.*

Spinal Accessory –
ACCESSORY PORTION – From *lateral tract of medulla oblongata below pneumogastric.* Joins pneumogastric, and assists in forming the *pharyngeal, superior & inferior laryngeal branches* of the latter.
SPINAL PORTION – *From lateral column of the cord as low as 5th or 6th cervical nerves.* – Enters skull through foramen magnum, leaves it through jugular foramen in same sheath as pneumogastric, and supplies under surface of trapezius.

Hypoglossal – From *groove between anterior pyramid & olivary body* by ten or twelve filaments, which form two bundles. Leaves skull through anterior condyloid foramen.
Anastomoses – With *pneumogastric, sympathetic, two first cervical nerves & gustatory.*
Branches – *Descendens noni, muscular* (to thyro- & genio-hyoid), *lingual* (to stylo-glossus, hyo-glossus, genio-hyo-glossus & substance of the tongue).

TABLEAU of the FIFTH NERVE.

From *side of pons Varolii* by two roots, *anterior small or motor*, *posterior large or sensory*.

Sensory root to Gasserian Ganglion, motor root to inferior maxillary nerve outside cranium.

Gasserian Ganglion gives off:

OPHTHALMIC — The smallest. Through outer wall of cavernous sinus below & externally to the other nerves, and divides into:

Lachrymal – The smallest of the three divisions of ophthalmic.
Frontal – The largest.
Nasal – Intermediate in size. Gives off branches: *ganglionic*, *long ciliary*, *infratrochlear*.

Ophthalmic, Ciliary or Lenticular Ganglion.

Three Roots – *Sensory*, from *nasal branch of ophthalmic*.
Motor, from *branch of 3rd nerve to inferior oblique*.
Sympathetic, from *cavernous plexus*.
Branches – The *ciliary nerves*.

SUPERIOR MAXILARY — Intermediate in size between ophthalmic & inferior maxillary. Through foramen rotundum, spheno-maxillary fossa, & infraorbital canal to infraorbital foramen, where divides into *palpebral*, *nasal*, *labial*. Gives off branches: *orbital or temporo-malar*, *spheno-palatine*, *posterior* & *anterior dental*.

Spheno-palatine or Meckel's Ganglion.

Three Roots – *Sensory*, from *superior maxillary*.
Motor, from *facial* through vidian.
Sympathetic, from *carotid plexus* also through vidian.
Branches:
Ascending – Small filaments to periosteum of orbit.
Descending – *Anterior or great palatine*, *external palatine*, *posterior or small palatine*.
Internal – *Superior nasal*, *naso-palatine*.
Posterior – *Vidian*, *pterygo-palatine*.

INFERIOR MAXILLARY — The largest, both sensory & motor. Divides just below base of skull into:

Anterior or Smaller Division – Principally motor. Divides into branches: *masseteric*, *two deep temporal*, *buccal*, *two pterygoid*.
Posterior or Larger Division – Sensory with a few motor fibres. Divides into *auriculo-temporal*, *gustatory*, *inferior dental*, the latter giving off the mylo-hyoid branch.

Otic or Arnold's Ganglion.

Three Roots – *Sensory*, from *auriculo-temporal*, and also from *glosso-pharyngeal* through small petrosal.
Motor, from *inferior maxillary* & its *internal pterygoid branch*, also from *facial* through small petrosal.
Sympathetic, from plexus on middle meningeal artery.
Branches – To *tensor palati* & *tensor tympani*.

Submaxillary Ganglion.

Three Roots – *Sensory*, from *gustatory*.
Motor, from *facial* through chorda tympani.
Sympathetic, from plexus on facial artery.
Branches – To mucous membrane of mouth, Wharton's duct, & submaxillary gland.

NOTES on the DEEP ORIGINS.

The *2nd Nerve* appears to derive deep origins, not from both Tubercula Quadrigemina, but from the anterior one only.

The points of origin of the *3rd & 4th Nerves* on the floor of the Aqueduct of Sylvius are so closely connected, that a *nucleus common to both nerves* is sometimes described. – A similar remark may be made respecting the origins of the *6th & facial Nerves* on the upper part of the floor of the Fourth Ventricle.

A few of the fibres of the *3rd nerve* are said to run downwards with the longitudinal fibres of the mesocephalon.

The *4th Nerve,* in addition to the fibres arising from the two nuclei described in the text (the one on floor of Aqueduct of Sylvius & the one on upper part of floor of Fourth Ventricle), has some fibres which decussate with their fellows in the middle line of the valve of Vieussens.

The two roots of the 5th Nerve appear to arise mainly from *two nuclei near the outer angle of the floor of the 4th ventricle.* If traced from the nerve, the sensory fibres are seen to turn outwards, and to end in a nucleus which is continuous below with the Grey Tubercle of Rolando; while the motor fibres are seen to turn inwards, and to end in a group of large cells on the inner side of the foregoing nucleus. – A few of the sensory fibres appear, however, to run, some of them inwards towards the middle line, some downwards towards the lower part of the meddulla (Lockhart Clarke).

Some of the fibres of the *Facial Nerve* decussate with their fellows in the middle line of the floor of the Fourth Ventricle.

Respecting the Auditory Nerve, see note on page 243.

See also Note on page 213.

SPINAL NERVES.

THE SPINAL NERVES.

Thirty-one pairs, - 8 cervical, 12 dorsal, 5 lumbar, 5 sacral, 1 coccygeal, - the first or sub-occipital nerve being counted as a cervical nerve, and each of the other nerves being named in correspondence with the vertebra beneath which it emerges.

They arise by two roots, anterior or motor, & posterior or sensory.

ANTERIOR ROOTS — The smaller, except in the case of the 1st cervical nerve. They arise from the so-called antero-lateral fissure of the cord, a somewhat irregular linear series of foramina gradually approaching the antero-median fissure inferiorly. Their fibres are collected into two bundles before they pierce the dura mater.

POSTERIOR ROOTS — The larger, except in the case of the 1st cervical nerve, but their fibres are more delicate than those of the anterior roots. They arise from the postero-lateral fissure, coalesce into two bundles, receive a sheath from the dura mater, and enter the corresponding ganglion.

Ganglia on the Posterior Roots — Oval, of a reddish grey colour, proportionate in size to the root upon which they lie, and generally situated in the inter-vertebral foramina just externally to the point where the anterior & posterior roots perforate the dura mater. The two first and the sacral & coccygeal ganglia must however be excepted: - the two first ganglia lie upon the posterior arch of the atlas & the laminæ of the axis respectively, the sacral & coccygeal ganglia lie in the sacral canal, the coccygeal ganglion being situated about the middle of its root. Internally these ganglia receive the two bundles of the posterior root, and are sometimes bilobate; immediately beyond them, the anterior & posterior roots coalesce to form the trunk of the corresponding spinal nerve. - The 1st ganglion is sometimes wanting, and, when present, is sometimes situated within the dura mater.

The roots of the 1st cervical nerve are small, short, horizontally directed or slightly ascending, and the anterior one is the larger of the two. The roots of the following cervical nerves, and of the 1st dorsal, increase in size, length & obliquity; and the posterior ones are considerably larger than the anterior ones. The roots of the other dorsal nerves are small & nearly uniform in size, and the posterior ones are but a little larger than the anterior ones. The roots of the lumbar & upper sacral nerves, again increase from above downwards, and the latter are the largest of all. On the contrary the roots of the lower sacral nerves diminish rapidly, and those of the last sacral nerve & of the coccygeal nerve are the smallest of all; the posterior roots of these lumbar, sacral & coccygeal nerves are also but a little larger than the anterior ones.

The length and the inclination of the roots of the nerves increase from the first to the last. The roots of the upper cervical nerves are, as those of the first nerve, short and nearly horizontal, for their point of exit from the spinal canal is nearly opposite their point of origin from the cord. The roots of the following nerves become larger and more oblique: - The intra-spinal course of the roots of the lower cervical nerves is measured by about the breadth of one vertebra, and that of the roots of the lower dorsal nerves by about the breadth of two vertebræ. The cord not descending lower than the first lumbar vertebra, the length of the roots of the lumbar, sacral, & coccygeal nerves increases from nerve to nerve by the breadth of one vertebra.

The trunk of each spinal nerve separates immediately into anterior & posterior primary divisions (Vide three following Tablets). - For the minute anatomy of the roots of the nerves Vide Structure of the Spinal Cord, 2nd Tablet.

POSTERIOR DIVISIONS of the SPINAL NERVES.

Smaller than the anterior, the two first excepted

POSTERIOR DIVISION OF

First Cervical Nerve (Suboccipital) – Larger than anterior. Emerges between occipital bone & posterior arch of atlas just behind vertebral artery, enters triangle formed by small posterior cranio-vertebral muscles, supplies these muscles & complexus, and joins with posterior division of 2nd cervical nerve. Sometimes gives off a small cutaneous branch, which branch, when it exists, accompanies occipital artery to integument of lower & back part of occiput, and joins with great & small occipital.

Second Cervical Nerve – Three or four times as large as anterior division, and the largest of the posterior cervical nerves. Emerges between posterior arch of atlas & lamina of axis, supplies inferior oblique, and after joining with posterior division of 1st & 3rd cervical nerves, divides into:

External Branch – Similar to external branches of six lower posterior cervical nerves, but somewhat larger, joins with corresponding branch of 3rd posterior cervical nerve, and supplies the same muscles, & also the complexus.

Internal Branch (Great Occipital Nerve) – Crosses triangle formed by posterior cranio-vertebral muscles, pierces complexus & trapezius, joins with small occipital & with ascending twig from internal branch of posterior division of 3rd, and supplies integument of back of head as far as vertex; gives off an auricular branch to back of ear.

Six Lower Cervical Nerves – Smaller than the anterior, and diminish in size from above downwards. Pass backwards and divide into: –

External Branches – Small; supply splenius, cervicalis ascendens, transversalis colli & trachelo-mastoid.

Internal Branches – *Three lower.* Small; pass inwards beneath semispinalis colli, which they supply, and are lost in the interspinales, multifidus spinæ, & complexus; twigs to the integument near the spine are however described by Cruveilhier, Sappey, & Hirschfeldt. – *The 3rd, 4th, & 5th.* Much larger, pass inwards between semispinalis & complexus, which they supply, pierce splenius & trapezius close to spine, and curve outwards to supply integument over trapezius. – Internal branch of 3rd nerve gives off beneath trapezius a small twig, which ascends on inner side of great occipital nerve, and pierces trapezius to supply integument of lower part of occiput; this twig is sometimes called the 3rd occipital nerve.

The name of "posterior cervical plexus" (Cruveilhier), is sometimes applied to the communications between the three first cervical nerves beneath the complexus.

Dorsal Nerves – Smaller than the anterior, and all pretty nearly of the same size. Pass backwards between transverse processes, and divide into: –

External Branches – *Six upper.* Small; pass backwards & outwards to interval between longissimus dorsi, transversalis colli & trachelo-mastoid on the one hand and the ilio-costalis & its accessory muscles on the other, and supply these muscles & levatores costarum. – *Six lower.* Larger; supply foregoing muscles, pierce serratus posticus inferior & latissimus dorsi in a line with angles of ribs, and bending outwards supply integument of back.

Internal Branches – *Six upper.* Large; pass inwards between semispinalis dorsi & multifidus spinæ, which they supply; pierce serratus posticus superior, rhomboidei & trapezius close to spine, and bend outwards to integument of back. – The *six lower* ones are smaller, and end in foregoing muscles without giving off any cutaneous filaments.

Lumbar Nerves – Diminish in size from above downwards. Pass backwards between transverse processes and between erector & multifidus spinæ, and divide into:

External Branches – the largest. Supply erector spinæ & intertransversales. The *three first* then pierce aponeurosis of latissimus dorsi, cross crest of the ilium, and supply integument of back part of gluteal region. The *two last* are lost in the muscles, an anastomotic filament joining however the 5th lumbar nerve to the 1st sacral.

Internal Branches – Pass backwards in grooves on articular processes, and are lost in multifidus spinæ. – A few small twigs to integument near spine are described by Sappey & Hirschfeldt.

Sacral Nerves – Small, and diminish in size from above downwards. The four upper issue from sacral canal through posterior sacral foramina, the last issues through termination of spinal canal.

The *three upper* divide into:

External Branches – The largest. Join in a first series of anastomotic loops on upper & back part of sacrum with last lumbar & 4th sacral, and pass outwards beneath gluteus maximus to posterior aspect of great sacro-sciatic ligament; here they join in a second series of loops and end in two or three cutaneous branches, which perforate lower & back part of gluteus maximus, and run outwards over its surface.

Internal Brs. – Small, and lost in multifidus spinæ.

The *two last* posterior sacral nerves are small, and do not divide into external & internal branches. They join with each other and with posterior division of coccygeal nerve, and are distributed to the fibrous structures on back of coccyx.

Coccygeal Nerve – Very small. Separates from anterior division in sacral canal, from which it issues through its terminal aperture. Communicates with last posterior sacral nerve, and ends in fibrous structures on back of coccyx.

N.—From the foregoing description it may be seen that the cutaneous nerves of the back are derived from the *internal* branches of the 2nd, 3rd, 4th, & 5th cervical, and six upper dorsal, and from the *external* branches of the six lower dorsal, & three first lumbar.

ANTERIOR DIVISIONS of the SPINAL NERVES.—1st T.

Larger than the posterior (the two first excepted), and connected by one or two filaments with the sympathetic.

ANTERIOR DIVISION OF

First Cervical Nerve (Suboccipital) – Small. Emerges between occipital bone & posterior arch of atlas below vertebral artery. Passes forwards on inner side of vertebral artery & rectus lateralis muscle, crosses foramen in transverse process of atlas, and descends in front of this process to join with ascending branch of the second. Supplies the rectus lateralis & the recti capitis antici major & minor, and communicates with the pneumogastric, hypoglossal, & superior cervical ganglion of sympathetic.

Second Cervical Nerve – Larger than foregoing, but still much smaller than the posterior division of the same nerve. Emerges between posterior arch of atlas & lamina of axis, passes forwards between transverse processes of the same vertebræ on outer side of vertebral artery, and divides into an ascending branch, which joins the first nerve, and a descending branch, which joins the third. Gives off the small occipital nerve.

Third Cervical Nerve – Much larger than the two foregoing, and larger than the posterior division of the same nerve, as are also the anterior divisions of all the following nerves. Passes downwards & outwards beneath sterno-mastoid, and divides into: –

ASCENDING BRANCH – Joins with second, sympathetic & spinal accessory, and divides into great auricular & superficial cervical.

DESCENDING BRANCH – Descends in front of scalenus anticus, and joins with 4th. Gives off a few of the superficial descending branches of the cervical plexus.

Fourth Cervical Nerve – Joins with 3rd & 5th, and usually also with the phrenic, passes downwards & outwards beneath sterno-mastoid, and gives off the greater part of the superficial descending branches of the cervical plexus.

Four Lower Cervical Nerves – Much larger than foregoing, and enter into formation of brachial plexus (Vide Brachial Plexus.)

Dorsal Nerves – Vide next Tablet.

Lumbar Nerves – Larger than the dorsal, and increase in size from above downwards. They communicate with the ganglia of the sympathetic by long slender filaments, which accompany the lumbar arteries round the sides of the bodies of the vertebræ beneath the psoas. The four upper nerves join to form the lumbar plexus. A branch from the 4th joins the 5th to form the *lumbo-sacral nerve or cord* (Vide Lumbar & Sacral Plexuses.)

Sacral Nerves – Diminish in size from above downwards. The four upper ones emerge from the anterior sacral foramina; the 5th, together with the anterior division of the coccygeal nerve, after emerging from the spinal canal through its terminal aperture, curves forwards between the sacrum & the coccyx. The two first, which are much the largest, the 3rd, and a part of the 4th, join with the lumbo-sacral cord to form the sacral plexus (Vide Sacral Plexus). The remainder of the 4th enters into the formation of the inferior hypogastric or pelvic plexus, (as do also a few twigs from the 3rd nerve, and sometimes also twigs from the 1st & 2nd), joins with the 5th nerve, and supplies the coccygeus, levator & sphincter ani, & the integument behind the anus. The 5th nerve communicates with the 4th, descends upon the coccygeus to tip of coccyx, and then perforates the muscle to integument between anus & coccyx; it joins with 4th & coccygeal.

Coccygeal Nerve – Very small. Emerges from termination of spinal canal, comes forward between sacrum & coccyx piercing the sacro-sciatic ligaments & the coccygeus, joins with 5th sacral, and is lost in the integument at back & side of coccyx.

ANTERIOR DIVISIONS of the SPINAL NERVES—2nd T.

DORSAL NERVES (Intercostal) — Twelve on each side, connected to the corresponding ganglion of the sympathetic, each of them by one or two very short filaments, and not joined into a plexus. May be divided into two sets: –

Six Upper or Thoracic Intercostals – Along six upper intercostal spaces below the vessels, lying first between the pleura & the external intercostals, then between the two intercostals, and finally between the pleura and the internal intercostals & triangularis sterni, crossing the internal mammary vessels. They give off branches: –

MUSCULAR – To corresponding intercostals & triangularis sterni; at the front of the the chest some cross the costal cartilages from one space to another.

LATERAL CUTANEOUS – Pierce intercostals & serratus magnus midway between vertebræ & sternum, and divide into: –

Anterior Offset – Forwards to integument of side of chest & mamma, and to upper digitations of external oblique.

Posterior Offset – Backwards to integument over latissimus dorsi & scapula.

The posterior offset of the lateral cutaneous branch of the 2nd intercostal nerve, is called the *intercosto-humeral nerve.* It crosses the axilla, joins with lesser internal cutaneous nerve or nerve of Wrisberg & with internal cutaneous branch of musculo-spiral, and pierces deep fascia to integument of upper inner & back part of arm; its size varies inversely with that of the nerve of Wrisberg. There is frequently a second intercosto-humeral nerve derived from the 3rd intercostal.

ANTERIOR CUTANEOUS – The terminal prolongation of the trunk. Pierce internal intercostals & pectoralis major by side of sternum, and turn outwards to integument of mamma & front of chest. The second joins with the clavicular branches of the superficial cervical plexus.

Six Lower or Thoraco-Abdominal Intercostals – Along five lower intercostal spaces, as foregoing, and behind costal cartilages (the last nerve runs along lower border of last rib in front of quadratus lumborum). Between internal oblique & transversalis to sheath of rectus, which they perforate. Give off branches:

MUSCULAR – To corresponding intercostals, & abdominal muscles.

LATERAL CUTANEOUS – Pierce external intercostals & external oblique in a line with corresponding branches of foregoing, and similarly divide into:

Anterior Offset – To integument of abdomen as far as rectus.

Posterior Offset – To integument over lower part of latissimus dorsi.

ANTERIOR CUTANEOUS – Become cutaneous near linea alba, and turn outwards towards lateral cutaneous nerves; their number & exact position are somewhat variable. – A second set are described by Cruveilhier & Hirschfeld as existing along the outer edge of the rectus.

The First Dorsal Nerve – Has no lateral cutaneous branch; or rather the branch of the 1st dorsal nerve, which corresponds to the lateral cutaneous branches of the other dorsal nerves, is a large trunk which enters into the formation of the brachial plexus. The continuation of the nerve along the first intercostal space is small, and ends in the first anterior cutaneous nerve.

The Last Dorsal Nerve – The largest. Occasionally connected with the first lumbar nerve by a slender branch, the *dorsi-lumbar nerve,* which descends in the substance of the quadratus lumborum. Runs along lower border of last rib, as above stated, and communicates between the internal oblique & transversalis with hypogastric branch of the ilio-hypogastric. Its *lateral cutaneous branch* is large; it pierces internal and external oblique above crest of the ilium, and crosses the crest to supply integument of front part of gluteal region.

CERVICAL PLEXUS.

Formed by anterior branches of four upper cervical nerves & loops connecting them, and lies beneath sterno-mastoid, in front of levator anguli scapulæ & scalenus medius & the four upper vertebræ. Communicates through loop between 4th & 5th nerves with brachial plexus, and, through its deep communicating branches, with pneumogastric, spinal accessory, hypoglossal & superior cervical ganglion of the sympathetic. – Its superficial branches communicate with facial & great occipital. Its branches are superficial & deep.

SUPERFICIAL BRANCHES — Wind round posterior border of sterno-mastoid one above the other in the following order, which is also the order in which they arise.

Small Occipital – From 2nd cervical; variable in size & sometimes double. Ascends behind sterno-mastoid to attollens aurem & posterior belly of occipito-frontalis, and perforates deep fascia to integument of back of side of head & upper part of back of pinna; its auricular branches being sometimes supplied by great occipital. Joins with great occipital, great auricular, & posterior auricular branch of facial. – The second small occipital, or smallest occipital, when it exists, arises from 3rd nerve, and sends twigs to back of neck.

Great Auricular – From 2nd & 3rd cervical nerves. Ascends upon sterno-mastoid & beneath platysma to near lobule of ear, where it divides into branches:

Auricular – Several, large; to integument of back of pinna, joining with posterior auricular branches of facial & pneumogastric. Some twigs supply outer surface of lobule, and one reaches outer surface of pinna through a fissure between antihelix & concha.

Mastoid – To integument behind ear, joining with post. auricular branch of facial.

Facial – To integument of face, and to parotid gland joining with facial.

Superficial Cervical – The largest; from 2nd & 3rd. Crosses sterno-mastoid beneath platysma & external jugular vein, and divides into brs.:

Ascending – Gives off an ascending twig to external jugular vein, joins with cervico-facial branch of facial, and, supplying platysma, pierces it to integument of upper & front part of neck.

Descending – Pierces platysma to integument of lower & front part of neck.

Superficial Descending – Several large branches from 3rd & 4th. Descend between sterno-mastoid & trapezius, and divide into branches:

Sternal – Cross origin of sterno-mastoid to integument of front of chest as far as middle line.

Clavicular – Cross clavicle (sometimes one of them perforates the bone) to integument over pectoralis major & deltoid, communicating with cutaneous branches of the superior intercostal nerves.

Acromial – Over acromion & clavicular origin of trapezius to integument of outer & back part of shoulder.

DEEP BRANCHES — Divided into internal & external.

INTERNAL — Are:

Communicating – From loop between 1st & 2nd cervical to pneumogastric, hypoglossal & superior cervical ganglion of sympathetic; and also from 3rd & 4th to cord of sympathetic below the ganglion.

Muscular – From 1st & 2nd, to recti capitis antici major & minor, and rectus lateralis.

Communicans Noni – From 2nd & 3rd. Downwards & forwards across sheath of carotid vessels (sometimes within the sheath, and then either in front of or behind internal jugular vein), and, near middle of neck, forms a loop with descendens noni; from convexity of which loop branches are given off to the sterno-hyoid & -thyroid and omo-hyoid.

Phrenic or Int. Respiratory of Sir C. Bell – From 3rd, 4th, and usually also from 5th. Downwards & inwards in front of scalenus anticus.

Between subclavian vein & 1st part of subclavian artery crossing internal mammary, and receiving a filament from sympathetic, sometimes another from 5th & 6th cervical nerves, and occasionally on the left side, one from the ansa hypoglossi.

Crosses arch of Aorta & pulmonary artery, on the left side.

Descends, on the right side, on outer side of right innominate vein & sup. vena cava.

In front of root of lung & along side of pericardium to diaphragm, and divides into branches which perforate the diaphragm and supply it by its under surface.

Both nerves give off twigs to the pericardium & pleura, and join with the phrenic plexus of the sympathetic, the right nerve sending also a few filaments to the diaphragmatic ganglion.

EXTERNAL — Are:

Communicating – Join spinal accessory in substance of sterno-mastoid, in occipital triangle, & beneath trapezius.

Muscular – To sterno-mastoid (from 2nd nerve), levator anguli scapulæ (from 3rd), scalenus medius & trapezius (from 3rd & 4th)

BRACHIAL PLEXUS.

Formed as follows by anterior divisions of 5th, 6th, 7th, & 8th cervical and 1st dorsal ns.:

Fifth & Sixth Cervical unite between anterior & middle scaleni, and are soon joined by *part of the seventh,* the OUTER CORD of the plexus being thus formed.

Eighth & First Dorsal unite behind scalenus anticus, and form the INNER CORD.

Remaining part of Seventh is joined a little lower down by two anastomotic branches given off by inner & outer cords, the third or POSTERIOR CORD being thus formed.

Varieties, more apparent than real, are frequently met with, resulting from the correspondingly increased or diminished size of the above mentioned anastomotic branches, and of the portion of the 7th nerve which assists in forming the posterior cord; the posterior cord being formed almost completely, in the one case, by the branches given off by the two other cords, and in the other, by the 7th nerve itself. Other varieties may also result from the two anastomotic branches arising from the inner & outer cords either higher or lower than usual, and from their joining the remainder of the 7th nerve at a higher or at a lower level.

Broad between anterior & middle scaleni, where anterior divisions of the nerves lie above 2nd part of subclavian artery; contracted opposite clavicle, where inner & outer cords lie at fore part of plexus on outer side of 3rd part of subclavian artery & of 1st part of axillary; again expanded in axilla, where the three cords lie on inner, outer & posterior aspects of 2nd part of axillary, and where they break up into the large nerves of upper limb.

Communicates with the cervical plexus through loop between 4th & 5th nerves & through branch from 5th nerve to phrenic, and with middle & inferior ganglia of sympathetic.

BRANCHES — Are

ABOVE THE CLAVICLE:

Post. or Long Thoracic, or Ext. Respiratory of Sir C. Bell – From 5th & 6th nerves, the two roots uniting in substance of scalenus anticus.

Deeply along side of chest behind axillary vessels & cords of brachial plexus as far as lowest digitation of serratus magnus.

Suprascapular – From back of trunk formed by union of 5th & 6th.

Backwards & outwards beneath trapezius & through suprascapular foramen to supraspinous fossa, where lies between supraspinatus & the bone.

Round spine of scapula to infraspinous fossa. – Supplies supra- & infra-spinati (two twigs to each), shoulder-joint & scapula.

Muscular – To rhomboidei & frequently to levator anguli scapulæ (from 5th nerve), subclavius (from 5th & 6th, anastomoses frequently with phrenic), scaleni & longus colli (variably from 6th 7th & 8th.)

Communicating – From 5th cervical to phrenic on anterior scalenus.

BELOW THE CLAVICLE — The branches are given off from the three cords as follows, from:

Outer Cord – External anterior thoracic, outer head of median, musculo-cutaneous or external cutaneous.

Inner Cord – Internal anterior thoracic, inner head of median, ulnar, internal cutaneous, lesser internal cutaneous or n. of Wrisberg.

Posterior Cord – The three subscapular nerves, musculo-spiral & circumflex.

Anterior Thoracic Nerves – Two, connected together by a loop on inner side of axillary artery.

EXTERNAL OR SUPERFICIAL – The largest. Crosses both axillary artery & vein to under surface of pectoralis major.

INTERNAL OR DEEP – The smallest. Between artery & vein, and gives twigs to under surface of both pectorales.

Subscapular Nerves – Three:

UPPER – The smallest; to upper part of subscapularis.

LOWER – To lower border of subscapularis & to teres major; the latter muscle having sometimes a separate nerve.

LONG – The largest. Along lower border of subscapularis to latissimus dorsi.

Nerves of the Arm – Vide three following Tablets.

MEDIAN & MUSCULO-CUTANEOUS NERVES.

MEDIAN NERVE.

From inner & outer cords of brachial plexus by two roots which surround 3rd part of axillary artery. – Lies at first on outer side (more or less so, but never quite in front) of 3rd part of axillary & upper part of brachial arteries.

Crosses brachial artery usually in front, and lies on its inner side at bend of elbow.

Between the two heads of pronator radii teres, and down middle of front of forearm, lying deeply at first between flexor sublimis & flexor profundus digitorum, and then superficially between tendon of flexor carpi radialis & outermost tendons of flexor sublimis.

Beneath anterior annular ligament to palm of hand, where lies in front of flexor tendons, and becomes enlarged and flattened, and divides into two

TERMINAL BRANCHES:

External – Supplies abductor, opponens & outer head of flexor brevis pollicis, and gives palmar digital branches to thumb & outer side of index finger.

Internal – Supplies the two outer lumbricales, and gives palmar digital branches to contiguous sides of index, middle and ring fingers. – The digital nerves are superficial to the digital arteries.

LATERAL BRANCHES:

None in upper-arm. In fore-arm:

Muscular – Arise near elbow; to all the superficial muscles of front of fore-arm except flexor carpi ulnaris.

Ant. Interosseous – With anterior interosseous artery between flexor longus pollicis & flexor profundus digitorum, supplying the former & the outer half of the latter, and ends in pronator quadratus.

Palmar Cutaneous – From lower part. Pierces deep fascia a little above anterior annular ligament and supplies integument of palm of hand & ball of thumb, joining with palmar cutaneous branch of ulnar, and with radial or anterior branch of external cutaneous.

MUSCULO-CUTANEOUS or EXTERNAL CUTANEOUS NERVE.

From outer cord of brachial plexus in common with outer head of median.

Through coraco-brachialis, and between biceps & brachialis anticus to a little above external condyle, where perforates deep fascia, and divides, behind median cephalic vein, into:

Anterior Branch – Along front of radial side of fore-arm as low as wrist, where lies in front of radial artery, and joins with radial nerve. Sends filaments over ball of thumb, and accompanies radial artery to back of carpus.

Posterior Branch – Along back of radial side of fore-arm, joining with radial and with external cutaneous branch of musculo-spiral.

Supplies coraco-brachialis, biceps & brachialis anticus, and sends twigs to humerus & to elbow-joint.

ULNAR, INT. CUTANEOUS, & LESSER INT. CUTANEOUS NERVES.

ULNAR NERVE.

From inner cord of brachial plexus in common with inner head of median, internal cutaneous & lesser internal cutaneous nerves. – Lies at first on inner side of 3rd part of axillary & upper part of brachial arteries.

Pierces internal intermuscular septum with inferior profunda, and descends in groove between olecranon & internal condyle.

Enters fore-arm between the two heads of flexor carpi ulnaris.

Descends on flexor profundus, being covered in upper part of fore-arm by flexor carpi ulnaris, lying superficially in lower part between tendon of latter muscle & innermost tendons of flexor sublimis digitorum. – Ulnar artery lies on outer side of nerve, and is distant from it in upper part of fore-arm.

Crosses anterior annular ligament a little behind artery & on outer side of pisiform bone, and divides into two

TERMINAL BRANCHES:

Superficial – To palmaris brevis, integument & 1½ fingers on inner side of hand, joining with median.

Deep – Between abductor & flexor brevis minimi digiti, and beneath flexor tendons with deep palmar arch. Supplies muscles of little finger, interossei, the two inner lumbricales, adductor pollicis & inner head of flexor brevis.

LATERAL BRANCHES:

None in upper-arm. In fore-arm:

Articular to Elbow Joint – Several, small, arise behind elbow.

Muscular – To flexor carpi ulnaris & inner half of flexor profundus.

Palmar Cutaneous – Arises a little below middle of fore-arm. With ulnar artery to integument of front of wrist & palm of hand, joining with palmar cutaneous branch of median & frequently with internal cutaneous.

Dorsal Cutaneous – Large, arises a little above wrist. Winds inwards beneath tendon of flexor carpi ulnaris, and supplies integument & 1½ fingers on inner side of back of hand, joining with radial.

Articular to the Wrist.

INTERNAL CUTANEOUS NERVE.

From inner cord of brachial plexus in common with inner head of median, ulnar & lesser internal cutaneous nerves.

Along inner side of brachial artery in front of lesser internal cutaneous, giving off a cutaneous filament to integument over biceps.

Pierces deep fascia with basilic vein, and divides into:

Anterior Branch – In front of, or sometimes behind, median basilic vein to integument of front of inner side of fore-arm as low as wrist, frequently joining with palmar cutaneous branch of ulnar.

Posterior Branch – Over internal condyle to integument of back of inner side of fore-arm to near wrist, joining with lesser internal cutaneous & dorsal cutaneous branch of ulnar.

LESSER INTERNAL CUTANEOUS N. or N. of WRISBERG.

From inner cord of brachial plexus in common with inner head of median, ulnar & internal cutaneous nerves.

Along inner side of axillary vein & brachial artery & behind internal cutaneous nerve to integument of back of lower third of arm, joining with intercosto-humeral & posterior branch of internal cutaneous.

Its size & communications vary considerably. Frequently intercosto-humeral nerve is large, and takes the place of nerve of Wrisberg, joining brachial plexus by a small filament only, or not at all.

MUSCULO-SPIRAL & CIRCUMFLEX NERVES.

MUSCULO-SPIRAL NERVE

The largest branch of brachial plexus. Arises from posterior cord in common with circumflex, and lies at first behind 3rd part of axillary artery & upper part of brachial.

Downwards & outwards in front of tendons of teres major & latissimus dorsi, and in spiral groove with superior profunda artery.

Between brachialis anticus & supinator longus to front of external condyle, where it divides into radial & posterior interosseous nerves. Its branches are:

Muscular – To triceps, anconeus, brachialis anticus, supinator longus, extensor carpi radialis longior.

Cutaneous – Three, small, one internal, two external; to integument of inner & posterior, and of outer & anterior aspects of arm, and of outer aspect of fore-arm.

RADIAL NERVE — The smaller.

Down front of outer side of fore-arm beneath supinator longus, lying on outer side of radial artery, which artery is distant from it in upper third & close to it in middle third. Winds outwards & backwards beneath tendon of supinator longus about three inches above wrist, pierces deep fascia, and divides into branches:

External – The smaller. To outer side & ball of thumb; joins with posterior branch of external cutaneous.

Internal – The larger. To integument, & remainder of 3½ fingers on outer side of hand; joins with external cutaneous & with dorsal cutaneous branch of ulnar. – Adjoining sides of middle & ring fingers may be supplied by same nerve, which may be either the radial or the ulnar.

POSTERIOR INTEROSSEOUS NERVE — The larger.

Through substance of supinator brevis to back of fore-arm.

Between superficial & deep muscles of posterior aspect of fore-arm, supplying them all except anconeus, supinator longus, & extensor carpi radialis longior.

Beneath extensores secundi internodii pollicis & communis digitorum to back of carpus, where it becomes ganglionic and supplies articulations of wrist.

CIRCUMFLEX NERVE

From posterior cord of brachial plexus in common with musculo-spiral.

Downwards & outwards behind axillary artery in front of subscapularis.

Backwards, with posterior circumflex vessels, through quadrilateral space bounded by teres major, teres minor, long head of triceps, & humerus. Gives off a small twig to shoulder-joint, and divides into:

Superior Branch – The larger. Round neck of humerus as far as anterior border of deltoid; supplies deltoid, and gives off cutaneous filaments which perforate the muscle to integument over lower part of shoulder.

Inferior Branch – The smaller. Supplies teres minor, back part of deltoid, & integument over back of shoulder; has frequently a gangliform enlargement on branch to teres minor.

LUMBAR PLEXUS.

Formed by anterior divisions of four upper lumbar nerves, and situated in substance of psoas, in front of transverse processes of the lumbar vertebræ.

Narrow above, where it usually receives a small branch from last dorsal nerve; broad below, where it is joined to the sacral plexus by a branch from 4th lumbar nerve & by lumbo-sacral nerve or cord.

Its arrangment is as follows: – (Vide Quain's diagram).

1st Lumbar Nerve – Gives off:
Ilio-hypogastric,
Ilio-inguinal,
Small part of Genito-crural,
Communicating branch to 2nd Lumbar.

2nd Lumbar Nerve – Completes
Genito-crural, – and gives off
Greater part of External Cutaneous, and
Communicating branch to 3rd Lumbar, from which communicating branch the *Anterior Crural, Obturator, & Accessory Obturator* nerves (when the latter exists) are partly derived.

3rd Lumbar Nerve – Completes
External Cutaneous, and gives off
Greater part of Anterior Crural, Obturator & Accessory Obturator Nerves (when the latter exists), and a
Communicating branch to 4th Lumbar.

4th Lumbar Nerve – Completes
Anterior Crural, Obturator, & Accessory Obturator Nerves, (when the latter exists), and gives off a
Large branch to 5th Lumbar, which large branch forms with the latter nerve the *Lumbo-Sacral Nerve or Cord.*

LATERAL BRANCHES of the LUMBAR PLEXUS.

ILIO-HYPOGASTRIC — From 1st lumbar.

Emerges from *upper part of outer border of Psoas.*

Crosses quadratus lumborum.

Perforates transversalis, and divides between it & internal oblique into branches: –

Iliac – Pierces internal & external oblique just above crest of ilium, and supplies skin of gluteal region behind lateral cutaneous branch of twelfth dorsal nerve.

Hypogastric – Forwards between internal oblique & transversalis, communicating with ilio-inguinal. Pierces internal oblique & aponeurosis of external oblique a little above the external abdominal ring, and supplies skin of hypogastric region.

ILIO-INGUINAL — From 1st lumbar; smaller than foregoing.

Pierces psoas, and crosses quadratus lumborum *immediately below ilio-hypogastric.*

Pierces transversalis, and communicates with hypogastric branch of ilio-hypogastric between that muscle and the internal oblique, which it pierces a little further on.

Through inguinal canal in front of spermatic cord; and supplies skin of upper & inner part of thigh and of scrotum & penis, or of labium pudendi.

Is sometimes small, and then ends by joining the ilio-hypogastric near crest of ilium; in that case a branch of the ilio-hypogastric takes the place of the ilio-inguinal.

GENITO-CRURAL — From 2nd lumbar nerve, and by a few filaments from the 1st.

Descends obliquely *through substance, and afterwards on anterior surface of psoas,* and divides into branches: -

Genital – Over external iliac artery, and through inguinal canal behind spermatic cord, to cremaster muscle & scrotum; – in female behind round ligament to labium.

Crural – Beneath Pouparts ligament on inner side of psoas. Pierces fascia lata on outer side of femoral artery, and supplies skin of upper and front part of thigh; communicates with middle cutaneous.

EXTERNAL CUTANEOUS — From 2nd lumbar nerve, and, by a few filaments, from the 3rd.

Pierces psoas muscle towards its middle and crosses iliacus.

Passes beneath Poupart's ligament through notch below anterior superior spine of ilium, and divides into branches: –

Anterior – Pierces fascia lata about four inches below Poupart's ligament, and supplies skin of anterior & outer aspects of thigh as low as knee.

Posterior – Supplies skin of outer & posterior aspect of thigh.

ANTERIOR CRURAL NERVE.

The largest branch of lumbar plexus. — Arises mainly from 3rd & 4th lumbar nerves, but receives also a fasciculus from the 2nd.

Descends through substance of psoas, and emerges from lower part of its outer border.

Passes down between psoas & iliacus, giving off small branches to iliacus & femoral artery.

Enters thigh beneath Poupart's ligament half an inch to outer side of femoral artery, and divides into anterior & posterior divisions.

ANTERIOR DIVISION - Gives off:

Middle Cutaneous Nerve - Pierces fascia lata & generally sartorius also (which muscle it then supplies) about *three or four inches below Poupart's ligament*, and divides into two branches to integument of front of thigh as low as knee. - Joins with crural branch of genito-crural, internal cutaneous & internal saphenous.

Internal Cutaneous Nerve - Crosses upper part of sheath of femoral vessels giving off a few cutaneous filaments, and divides into:

Anterior or External Branch - Pierces fascia lata about *lower third of thigh*, and divides into branches to integument of inner & outer sides of knee; joins with middle cutaneous & long saphenous.

Inner or Posterior Branch - Along posterior border of sartorius, joining in a plexiform network beneath fascia with long saphenous & obturator. Pierces fascia lata *a little above inner side of knee;* supplies integument of inner sides of thigh & upper part of leg, joining with int. saphenous.

Long or Internal Saphenous Nerve - The largest branch of anterior division (arises sometimes from posterior division).

Along whole length of outer side of femoral artery, lying first at a slight distance from it, and then close to it.

Pierces fibrous band which extends from vastus internus to tendons of adductors longus & magnus and forms anterior wall of Hunter's canal.

Pierces deep fascia *between tendons of sartorius & gracilis,* and joins with internal cutaneous.

Passes with internal saphenous vein along inner side of leg & divides into two branches; one terminates at inner ankle, the other passes in front of ankle to integument of inner side of foot.

Joins in plexiform network above mentioned with internal cutaneous & obturator nerves; - gives off to integument of front of knee a large branch, nervus cutaneus patellæ, which, joining with external, middle & internal cutaneous nerves & other branches of long saphenous, forms plexus patellæ in front of knee; - gives off numerous branches to integument of front & inner side of leg.

POSTERIOR DIVISION - Gives off:

Muscular Branches

To all the muscles of front of thigh except tensor vaginæ femoris supplied by superior gluteal n., and Sartorius supplied by filaments from middle or sometimes from internal cutaneous nerve. [pectineus is partly supplied by obturator nerve]

Articular Branches

Two: - one from nerve to vastus externus, long & slender & distributed to front of capsule; one from nerve to vastus internus, accompanies deep branch of anastomotica magna to inner side of capsule.

OBTURATOR NERVE

Arises mainly from 3rd & 4th lumbar nerves, but receives also a fasciculus from the 2nd (Sappey, Hirschfeldt, & Quain's diagram of lumbar plexus).

Descends through inner fibres of psoas, and emerges from inner border of that muscle opposite brim of pelvis.

Along outer wall of pelvis above obturator vessels to upper part of obturator foramen; enters thigh, and divides into:

Anterior Branch – The smaller. Descends in front of adductor brevis, and behind pectineus & adductor longus, to femoral artery, upon which it is distributed below the latter muscle. Gives off branches: –

Articular – To hip-joint; arises near obturator foramen.

Muscular – To gracilis & adductor longus, and sometimes to pectineus & adductor brevis;

Anastomotic to Internal Cutaneous & Internal Saphenous Nerves – Arises opposite lower border of adductor longus, and forms with the foregoing nerves a plexiform network beneath deep fascia of thigh.

Sometimes this anterior branch of the obturator nerve, and its communicating offset to the internal cutaneous & internal saphenous nerves, are larger than usual. The latter then gives off cutaneous filaments to the skin of the lower & inner part of the thigh, and descends along the posterior border of the sartorius to the inner side of the knee-joint; here it pierces the deep fascia, communicates again with the internal saphenous nerve (which is then smaller than usual), and supplies the skin of the inner side of the leg as low as its middle.

Posterior Branch – The larger. Pierces upper fibres of obturator externus, and descends behind adductor brevis in front of adductor magnus; gives off branches: –

Muscular – To obturator externus & adductor magnus (and to adductor brevis, when the latter is not supplied by the anterior branch of the nerve).

Articular – Through opening in lower part of adductor magnus, and upon the popliteal artery to back of knee-joint.

ACCESSORY OBTURATOR NERVE

Arises (when it exists) either directly from obturator nerve, or, by separate filaments, from the 2nd, 3rd, & 4th lumbar.

Descends along inner side of psoas, crosses front of pubes, gets behind pectineus, and divides into branches to pectineus & hip-joint. Communicates with anterior branch of obturator nerve; the communicating branch is sometimes large, and is then prolonged as a cutaneous nerve to the thigh & leg (Gray)

ACRAL PLEXUS.

Formed by lumbo-sacral cord & anterior divisions of the three first sacral nerves, and part of that of the fourth.

Triangular in shape, – its constituent nerve-fibres converging to form one broad flat cord, which leaves pelvis through lower part of great sacro-sciatic foramen below pyriformis, and immediately divides into Small sciatic, Great sciatic & Pudic.

Rests upon pyriformis, and is covered by the pelvic fascia & by the two terminal branches (sciatic & pudic) of anterior division of internal iliac artery.

BRANCHES :

Superior Gluteal – From back of lumbo-sacral cord.

With gluteal vessels through upper part of great sacro-sciatic foramen above pyriformis, and divides into:

Superior Branch – Along middle curved line on dorsum ilii with superior division of deep branch of gluteal artery. Supplies glutei medius & minimus.

Inferior Branch – Directly forwards between glutei medius & minimus, which it also supplies, and terminates in tensor vaginæ femoris.

Muscular – To pyriformis, obturator internus, gemelli & quadratus femoris. – The nerve to obturator internus passes behind spine of ischium and through lesser sacro-sciatic foramen to inner surface of the muscle. – The gemellus inferior and the quadratus femoris are supplied by a common branch, which runs between capsule of hip-joint and the obturator internus & gemelli, and gives off an articular filament to the joint.

Small Sciatic – From lower & back part of sacral plexus.

With sciatic vessels through lower part of great sacro-sciatic foramen below pyriformis.

Descends beneath gluteus maximus on inner side of great sciatic nerve.

Along back of thigh beneath fascia lata to lower part of popliteal space.

Perforates deep fascia, and accompanies external saphenous vein to skin of back of leg; communicates with external saphenous nerve. Gives off branches:

Inferior Gluteal – Several, large; to under surface of gluteus maximus.

Inferior Pudendal – Forwards below tuber ischii to skin of perinæum and upper & inner part of thigh, and to scrotum or labium.

Cutaneous – *Descending*. To skin of inner & outer sides of back of thigh, popliteal space and back of leg.

Ascending. Wind round lower border of gluteus maximus to integument over its surface.

Great Sciatic – Vide next Tablet but one.

Pudic – Vide next Tablet.

PUDIC NERVE.

From lower part of sacral plexus.

With pudic artery through lower part of great sacro-sciatic foramen on inner side o great sciatic nerve

Winds round spine of ischium, and re-enters pelvis through lesser sacro-sciatic foramen where it gives off inferior hæmorrhoidal nerve

Forwards along outer wall of ischio-rectal fossa above pudic artery, both nerve & artery being covered by obturator fascia, and divides into perinæal nerve & dorsa nerve of the peni

PERINÆAL NERVE — The larger. Accompanies superficial perinæal artery, and divide into branches:

Cutaneous or Superficial Perinæal – Two in number:

Posterior or Internal – Gives filaments to skin in front of anus (and to th sphincter ani, Gray), and communicates with the inferior hæmorrhoida nerve. It then passes forwards to the scrotum or labium on the inner sid of the following nerve with which it communicates anteriorly

Anterior or External – Forwards on outer side of foregoing to scrotum & integument of penis, or labium. Communicates with foregoing, and with inferio pudendal, and gives a few twigs to levator ani

Muscular – Generally arise by a common trunk, which passes forwards and inward under cover of transversus perinæi, and supplies anterior extremity o sphincter ani, transversus perinæi, erector penis, accelerator urinæ & compressor urethræ; a twig is given to the bulb of the urethra

DORSAL NERVE OF THE PENIS — The smaller. With pudic artery along rami o ischium & pubes between the two layers of deep perinæal fascia, and through suspensory ligament and along dorsum of penis to glans. Supplies skin of dorsum & sides of penis, and gives a large branch to corpus cavernosum. – *Dorsal nerve of clitoris* in female is smaller, but similarly distributed

Inferior Hæmorrhoidal Nerve – May be derived directly from sacral plexus Crosses ischio-rectal fossa towards lower end of rectum, and gives off numerous branches to sphincter ani & integument round anus; communicates with superficial perinæal & inferior pudendal

REAT SCIATIC NERVE

Arises from the lumbo-sacral cord & the four upper sacral nerves, and is the continuation of the sacral plexus.

Through great sacro-sciatic foramen below pyriformis, on outer side of pudic vessels & nerve.

Downwards between trochanter major & tuber ischii, behind external rotator muscles & adductor magnus, to lower third of back of thigh, where it divides into external & internal popliteal.

Is covered by gluteus maximus & biceps. Gives off branches: –

Articular – To back of hip-joint.

Muscular – To hamstring muscles & adductor magnus.

EXTERNAL POPLITEAL NERVE.

The smaller of the two terminal branches of great sciatic.

Along outer side of popliteal space close to biceps.

Pierces peroneus longus an inch below head of fibula, and divides into anterior tibial & musculo-cutaneous. Gives off branches: –

Articular – Three; accompany the two external articular & the recurrent tibial arteries to knee-joint.

Cutaneous – Two or three; supply integument of outer & back part of leg; one, the communicans fibularis, crossses outer head of gastrocnemius, and joins the communicans tibialis to form external or short saphenous nerve (V. next Tablet).

Anterior Tibial Nerve – Beneath extensor longus digitorum to front of interosseous membrane; along outer side, in front of, and again along outer side of anterior tibial artery to front of ankle-joint. – Supplies muscles of front of leg, and divides into:

External Branch – Beneath extensor brevis digitorum, which it supplies; becomes ganglionic, and supplies articulations of tarsus.

Internal Branch – With dorsalis pedis artery along inner side of dorsum of foot; supplies adjoining sides of great & second toes, and joins with musculo-cutaneous.

Musculo-Cutaneous Nerve – Between peronei muscles, which it supplies, and extensor longus digitorum; pierces deep fascia about lower third of front of leg, and divides into:

Internal Branch – Supplies inner side of great toe, adjoining sides of 2nd & 3rd toes, & integument of inner side of foot; joins with internal saphenous & anterior tibial.

External Branch – Supplies adjoining sides of 3rd, 4th, & 5th toes, and integument of outer side of foot; joins with external or short saphenous.

INTERNAL POPLITEAL NERVE.

The larger of the two terminal branches of great sciatic.

Through middle of popliteal space to lower border of popliteus, where it becomes poster tibi

Is first superficial & external and at a distance from, then superficial & internal and cl to, popliteal vessels. – Its branches a

Articular – Three; accompany the two internal & the azygos articu arteries to knee-joi

Muscular – To gastrocnemius, plantaris, popliteus, soleus.

Communicans Tibialis – Between heads of gastrocnemius to middle back of leg, where it pierces deep fascia and joins communica fibularis to form t

External Saphenous Nerve – Behind outer malleolus with exter saphenous vein, and supplies integument of outer side of f & little toe; joins with musculo-cutaneous. Is sometin larger than usual, and then supplies both sides of little t and outer side of 4

POSTERIOR TIBIAL NERVE.

Commences at lower border of popliteus.

Beneath arch of soleus, superficial muscles, & deep layer of fascia to interval tween inner malleolus & heel, where it divides into internal & external plant

Is first internal & posterior to posterior tibial vessels, but soon passes to th outer side. – Its branches ar

Muscular –To flexor longus pollicis, flexor longus digitorum, tibialis postic

Plantar Cutaneous – Perforates internal annular ligament to integume of heel & inner part of sole of fo

Internal Plantar Nerve – The larger. With internal plantar artery between abdu tor pollicis & flexor brevis digitorum, and divides into four digit branches to 3½ toes on inner side of foot. Supplies flexor brev digitorum, abductor & flexor brevis pollicis, two inner lumbrical integument of sole of foot & articulations of tarsus; joins wi external planta

External Plantar Nerve – The smaller. With external plantar artery betwe flexors accessorius & brevis, and then between flexor brevis & a ductor minimi digiti; supplies the first & the last of the muscles, and divides int

Superficial Branch – Supplies 1½ toes on outer side of foot, flexor brev minimi digiti & interossei of 4th space; joins with intern planta

Deep Branch – Accompanies plantar arch; supplies remaining interossei lumbricales, adductor pollicis, & transversus pedi

SYMPATHETIC NERVES.

GANGLIATED CORDS & GANGLIA.

GANGLIATED CORDS — Lie on each side & along the whole length of spinal column, converging inferiorly upon the coccyx in the ganglion impar, and being prolonged superiorl into the head along internal carotid artery. They are usually single, sometimes double occasionally wanting here & there. Relatively to the size of the ganglia they are larges in the dorsal region. They are divided into

Cervical Portion – Lies in front of transverse processss of cervical vertebræ behin internal jugular vein, and presents three ganglia (Vide Cervical portion of Sympathetic)

Thoracic Portion – Lies in front of heads of ribs & intercostal vessels, beneath pleuræ on outer side of venæ azygos, at first at a small distance from, and then close to bodies of vertebræ. It presents eleven or twelve ganglia

Lumbar Portion – Penetrates into abdomen, on right side through a small opening in right crus of diaphragm, on left side either through aortic opening or through small separate opening in left crus. It lies in front of bodies of vertebræ on inne side of psoas, behind inferior vena cava on the right side, behind abdominal aorta on the left. It presents four or five ganglia

Sacral Portion – Lies in front of sacrum on inner side of anterior sacral foramina, and converging towards its fellow inferiorly, usually ends in the ganglion impar

PREVERTEBRAL GANGLIA — Usually three cervical, eleven or twelve dorsal, four o five lumbar, four sacral, one coccygeal. More or less oval or triangular in shape, an elongated from above downward

Cervical – Vide cervical portion of sympathetic.

Dorsal – Lie most of them in front of heads of ribs, the nine or ten first at a little distanc from, the two or three last close to, bodies of corresponding vertebræ; occasionall one or two ganglia lie opposite the corresponding intervertebral foramina. The are smaller than the cervical & lumbar. The first one is the largest and is ofte blended with the inferior cervical. The last one is usually stellate in shape, an is sometimes blended with the first lumbar. – They present

Roots, or Branches of Communication with the Dorsal Nerves – Usually two i number: – Either both ascend obliquely upwards & outwards to join th dorsal nerve above just before its bifurcation, or one ascends as above described, and the other descends to join the dorsal nerve below in corresponding situation. Sometimes one or two ganglia have a third root resultin from bifurcation of one of the roots to adjoining dorsal nerves, and even occasionally, an additional root to second dorsal nerve above

Internal Branches, or Branches of Distribution – Those from five or six upper ganglia are small & greyish; they mainly supply thoracic aorta & its branches & bodies of vertebræ & their ligaments; those from third & fourth ganglia joi posterior pulmonary plexus. Those from six or seven lower ganglia are large & whiter; they give off a few small branches to aorta, and join to form th great, lesser, & last splanchnic nerves (V. Solar Plexus)

Lumbar – Rather larger & more distinct than the dorsal, and situated at a greater distanc from the corresponding intervertebral foramina, the first one often lying opposit body of second lumbar vertebra, and the last one opposite sacro-vertebral articulation. – They present

Roots, or Branches of Communication with the Lumbar Nerves – Two or three for each Are longer & more slender than those of dorsal ganglia, and pass beneath th fibrous arches of psoas in company with lumbar arteries & veins

Internal Branches, or Branches of Distribution – Give a few twigs to bodies of vertebræ & their ligaments, and assist in forming the aortic & hypogastric plexuses

Sacral – Smaller than the dorsal & lumbar, and diminish in size as they descend; li close to inner side of anterior sacral foramina, those of opposite sides approximating as they descend, and usually blend in front of coccyx in a median ganglion, th coccygeal ganglion or ganglion impar. – They presen

Roots, or Branches of Communication with the Sacral Nerves – Usually two for each ganglion; are short & small

Internal Branches, or Branches of Distribution – Those of the two upper ganglia joi inferior hypogastric or pelvic plexus; the others descend upon the arteria sacra media, and supply the sacrum & coccyx & their ligaments, and th coccygeal glanc

RANIAL PORTION of the SYMPATHETIC

Consists of the carotid & cavernous plexuses and of their prolongations upon the branches of the internal carotid arteries.

CAROTID PLEXUS — Is situated on the *outer side of the petrous portion of the internal carotid artery just before its entrance into the cavernous sinus,* and is formed principally by the *outer,* but partly also by the inner, of the two divisions of the ascending branch given off by the superior cervical ganglion of the sympathetic. A small ganglion, the *carotid ganglion,* is sometimes found on one of its branches.

Its Communications are with:

Tympanic Branch of the Glosso-pharyngeal or Jacobson's Nerve through posterior wall of carotid canal;

Spheno-palatine Ganglion — This communicating branch crosses inferiorly the cartilaginous substance which closes the foramen lacerum medium. Then, under the name of *carotid branch of the Vidian nerve,* it joins the cranial branch of the same (great petrosal branch of the facial) and the two together, under the name of Vidian nerve, pass through the Vidian canal to the back of the spheno-palatine ganglion;

Sixth Cranial Nerve — One or two filaments join this nerve as it lies on the outer side of the internal carotid artery;

Gasserian Ganglion.

CAVERNOUS PLEXUS — Is situated *below, and to the inner side of the cavernous portion of the internal carotid artery by the side of the sella turcica,* and is formed principally by the *inner,* but partly also by the outer, of the two divisions of the ascending branch of the superior cervical ganglion of the sympathetic.

Its Communications are with:

Third, Fourth & Sixth Cranial Ns.,
Ophthlmic Br. of the Fifth; } The respective brs. of comm. join these ns. as they penetrate into the orbit.

Lenticular or Ciliary Gangl. — This branch of communication accompanies the nasal branch of the ophthalmic, or passes separately to the ganglion.

THEIR PROLONGATIONS upon the Brs. of the INT. CAROTID

These form *plexuses upon* the *cerebral arteries* to the pia mater of the brain, and upon the *ophthalmic arteries* to the contents of the orbit, a minute plexus accompanying, it is said, the arteria centralis retinæ, into the interior of the eyeball. — A small ganglion, the *ganglion of Ribes,* is said to exist sometimes on the anterior communicating artery, and to connect the sympathetic nerves of the right & left sides.

CERVICAL PORTION of the SYMPATHETIC

Consists on each side of three ganglia, the superior, middle & inferior cervical (of which the middle one is sometimes wanting), and of their respective branches of communication & distribution.

THE THREE GANGLIA:

Superior Cervical Ganglion – The *largest*, usually fusiform in shape and situated between the rectus capitis anticus major & the internal carotid *opposite the 2nd & 3rd cervical vertebræ;* sometimes irregular in shape & situated a little lower than usual.

Middle Cervical Ganglion – When present, is the *smallest* of the three and is situated *opposite the 5th cervical vertebra* in the vicinity of the inferior thyroid artery.

Inferior Cervical Ganglion – *Intermediate in size* between the two others, and situated *between the neck of the first rib & the transverse process of the last cervical vertebra* on inner side of superior intercostal artery; is irregular in form, and is frequently joined with the first thoracic ganglion.

THEIR COMMUNICATIONS:

These ganglia communicate *with each other* through the main cord of the sympathetic, and with the cerebro-spinal nerves as follows:

SUPERIOR CERVICAL GANGLION — With:

- *Petrosal Ganglion of the Glosso-pharyngeal;*
- *Both Ganglia of the Pneumogastric;*
- *Trunk of the Hypoglossal;*
- *Four upper Cervical Nerves* – (Sometimes with the two upper nerves only, the branches of communication with the 3rd & 4th nerves occasionally joining the cord of the sympathetic a little below the ganglion).

MIDDLE CERVICAL GANGLION — With:

- *Fifth & Sixth Cervical Nerves* – (In case of absence of the middle cervical ganglion the 5th & 6th cervical nerves join with the cord of the sympathetic between the superior & inferior ganglia.

INFERIOR CERVICAL GANGLION — With:

- *Seventh & Eighth Cervical Nerves.*

THEIR BRANCHES OF DISTRIBUTION — Vide next Tablet.

BRS. of DISTRIB. of the CERV. G. of the SYMPATHETIC.

These ganglia give off branches to the neighbouring arteries and to the viscera as follows:

BRS. to the NEIGHBOURING ARTERIES:

SUP. CERVICAL GANGLION — Gives off:

ASCENDING BRANCH TO INTERNAL CAROTID ARTERY & ITS BRANCHES — Large, soft, of a reddish grey colour, and appears to be the direct continuation of the ganglion. It passes along the posterior aspect of internal carotid artery and divides on reaching the carotid canal into internal & external branches.

INTERNAL BRANCH – The smaller; ascends on inner side of internal carotid artery, communicating with the outer branch, and goes to form the greater part of the cavernous plexus.

EXTERNAL BRANCH – The larger; ascends on outer side of internal carotid artery, communicating with the inner branch, and goes to form the greater part of the carotid plexus.

ANTERIOR BRANCHES TO EXTERNAL CAROTID ARTERY & ITS BRANCHES — Form *delicate plexuses which accompany the external carotid artery & its branches,* and on the filaments of which small ganglia are sometimes found. – From the plexus on the trunk of the external carotid artery a communicating branch is given off to the digastric branch of the facial nerve; from the plexus on the facial artery is derived the sympathetic root of the submaxillary ganglion; from the plexus on the internal maxillary artery is derived the sympathetic root of the otic ganglion and also a twig to the intumescentia gangliformis of the facial.

MIDDLE CERVICAL GANGLION — Gives off:

THYROID BRANCHES — Accompany the inferior thyroid artery, communicating with superior cardiac nerve, and reach the thyroid body, in which they communicate with the recurrent & external laryngeal nerves.

INF. CERVICAL GANGLION — Gives off:

BRANCHES TO VERTEBRAL ARTERY — Form a plexus round that vessel, and communicate with the cervical nerves as high as the 4th.

BRS. to the VISCERA — Are the:

Cardiac Nerves – Vide Next Tablet.

Pharyngeal Branches of the Superior Cervical Ganglion – Join with the pharyngeal branches of the *glosso-pharyngeal, pneumogastric, & external laryngeal* to form the pharyngeal plexus, which plexus supplies the muscles & the mucous membrane of the pharynx.

Thyroid Branches of the Middle Cervical Ganglion – Vide above.

NERVES of the HEART

Are derived from the cardiac plexuses, which plexuses are formed by the cardiac branch of the sympathetic and of the pneumogastric & recurrent laryngeal.

CARDIAC NERVES — Are the three cardiac nerves of the sympathetic, the cervica cardiac & the thoracic-cardiac nerves of the pneumogastric, and the cardiac bra ches of the recurrent laryngeal.

CARDIAC NERVES OF THE SYMPATHETIC — Are three in numb *superior or superficial, middle or great, & inferior,* and arise normally *from* the co responding *cervical ganglia.* The superior cardiac nerve, however, frequent arises partly from the communicating cord below the superior ganglion, and t inferior one partly from the first dorsal ganglion; when the middle ganglion absent the middle cardiac nerve arises from the communicating cord betwe the superior & inferior ganglia.

These nerves pass downwards & inwards *to the base of the heart* either singly or in co nection with each other or with the other cardiac nerves, varying considerab in their relative size and in their precise relations to adjoining structur when one of them is smaller than usual one of the others is increased in size.

On the *right side* of the neck the *superior & the middle* cardiac ner pass downwards *behind the common carotid* artery, the former passing also in fr of the inferior thyroid artery & recurrent laryngeal nerve. They then *cross subclavian artery* either in front or behind, and descend *upon the trachea to* right side of the *great or deep cardiac plexus.* – On the *left side* the *superior car nerve* usually descends into the thorax *between & in front of* the *left common car & left subclavian* arteries and crosses anteriorly the *arch of the aorta to* the *supe cial cardiac plexus;* sometimes however it lies deeper than usual and then pas behind the aorta to the deep cardiac plexus. – The *left middle cardiac nerve* pas into the thorax *between & behind the left common carotid & left subclavian arte* and then descends *behind the arch of the aorta to* the left side of the *deep car plexus.*

The *inferior cardiac nerve* passes downwards & inwards *to the deep car plexus behind the subclavian artery,* and also, on the right side, behind the *innomin*

CARDIAC NS. of the PNEUMOGASTRIC & RECURR. LARYNGE

Are divided into:

Cervical Cardiac – Are divided into:

Upper Cervical Cardiac – Small branches which join the cardiac ner of the sympathetic.

Lower Cervical Cardiac – One large branch which, on the right side, d cends along the innominate artery and joins one of the cardiac ner destined to the deep cardiac plexus, and, on the left side, crosses arch of the aorta to the superficial cardiac plexus.

Thoracic Cardiac – Arise on the right side both from the trunk of the pneu gastric & from its recurrent laryngeal branch, but on the left side from recurrent branch only. They all go to the deep cardiac plexus either sin or in connection with the other deep cardiac nerves.

THE CARDIAC PLEXUSES.

The cardiac nerves form two primary cardiac plexuses termed the superficial & the deep or great, and two secondary plexuses, the anterior & the posterior coronary, which two latter plexuses are derived from the preceding, as are also in part the anterior & the posterior pulmonary plexuses.

SUPERFICIAL CARDIAC PLEXUS — The smaller. Is situated beneath arch of aorta in front of right pulmonary artery and on right side of ductus arteriosus. It communicates by several filaments with the left half of the deep cardiac plexus.

It is formed by the left superior cardiac nerve of the sympathetic, the left inferior cervical cardiac branch of the pneumogastric, and by several filaments from the deep cardiac plexus. It often presents a small ganglion, the ganglion of Wrisberg.

It gives off the greater part of anterior coronary plexus, and several filaments to anterior pulmonary plexus of left side.

DEEP OR GREAT CARDIAC PLEXUS — The larger. Is situated between trachea & arch of aorta, its right half lying above right branch of pulmonary artery, its left half lying rather on left side of trachea and being connected by several filaments with the superficial plexus.

It is usually formed by every one of the cardiac nerves excepting the left superior cardiac nerve of sympathetic & left inferior cervical cardiac nerve of pneumogastric.

Its right half sends branches - behind right pulmonary artery to posterior coronary plexus & to right auricle; - in front of right pulmonary artery, outwards, to right anterior pulmonary plexus, inwards, in front of pulmonary trunk to anterior coronary plexus. - Its left half gives off: - several filaments to superficial cardiac plexus, numerous filaments to posterior coronary plexus & to left auricle, a few branches to left anterior pulmonary plexus.

ANTERIOR CORONARY PLEXUS — Is derived chiefly from the superficial cardiac plexus, but partly also from the deep. It passes forwards between aorta & pulmonary artery and accompanies the left or anterior coronary artery & its branches.

POSTERIOR CORONARY PLEXUS — Is derived chiefly from the left half of the deep cardiac plexus, but partly also from the right. Its branches accompany the right or posterior coronary artery and its branches.

The filaments of the coronary plexuses ramify in the substance of the heart and beneath the pericardium & endocardium. Numerous small ganglia are found upon them, especially in the vicinity of the boundary rings between the auricles & ventricles.

SPLANCHNIC NERVES & SOLAR PLEXUS.

SPLANCHNIC NERVES — Usually three in number, and termed *great, lesser, & least.*

Arise as follows from the six or seven lower dorsal ganglia:

GREAT SPLANCHNIC NERVE – Ganglia from 5th or 6th to 9th or 10th: – Is also connected with the dorsal ganglia above as high as the 3rd, or sometimes even as high as the 1st.

LESSER SPLANCHNIC NERVE – 10th & 11th ganglia.

LEAST SPLANCHNIC NERVE – 12th ganglion.

Pass downwards & inwards upon bodies of vertebræ being either more or less separate & distinct from each other, or more or less plexiform, and frequently presenting, when plexiform, either one relatively large ganglion, the ganglion splanchnicum, or several smaller ones.

Perforate diaphragm conjointly or separately.

End, the two first mainly in solar plexus, the last mainly in the renal. – The majority of the fibres of the great splanchnic nerve descend directly to the semilunar ganglion of same side. The great splanchnic nerves are white & firm in texture, as are also the branches of the superior mesenteric plexus.

SOLAR or EPIGASTRIC PLEXUS

Is formed mainly by the splanchnic nerves & the right pneumogastric, but is also reinforced to some extent by the left pneumogastric & by both phrenics.

It lies behind the stomach, between the suprarenal capsules, above the pancreas; and surrounds the cœliac axis & root of superior mesenteric artery with a dense network of nerves & ganglia, the two largest of which ganglia are the

SEMILUNAR GANGLIA – Irregularly semilunar in shape, and lie in front of crura of diaphragm on inner side of suprarenal capsules. Their upper enlarged extremity receives the greater part of great splanchnic nerve. Their smaller & lower extremity, and their outer convex & inner concave borders give off large offsets to solar plexus.

Its filaments spread out upon the branches of first part of abdominal aorta & their divisions, forming plexuses proportionate in size to, and, of the same name as, the arteries on which they are found; the plexus is then continued downwards upon the aorta into the aortic or lumbo-aortic plexus.

From the solar plexus are thus derived the:

Phrenic Plexus – From upper part of semilunar ganglion; joins with phrenic nerves from cervical plexus, and sends filaments to the suprarenal capsules. – On the right side, on which side it is the largest, it presents a small ganglion, the ganglion diaphragmaticum, from which ganglion small twigs may be traced to suprarenal capsules, vena cava, & hepatic plexus.

Cœliac Plexus – Large, partly formed by left pneumogastric. Divides into plexuses:

GASTRIC – With gastric artery along lower curvature of stomach; joins with pneumogastrics & pyloric plexus.

HEPATIC – To liver upon hepatic vessels & bile ducts; joins with left pneumogastric & right phrenic. Ramifies on hepatic artery & vena portæ, and gives off plexuses:

- *Pyloric* – To pylorus; joins with gastric.
- *Gastro-duodenalis* – Descends behind duodenum, and divides into right gastro-epiploic & superior pancreatico-duodenal.
- *Cystic* – To gall-bladder.

SPLENIC – From solar plexus, right semilunar ganglion & right pneumogastric. Upon splenic artery to spleen, giving off plexuses:

- *Pancreatic*;
- *Left gastro-epiploic*; and
- *Twigs to stomach* along vasa brevia.

Superior Mesenteric Plexus – From lower part of solar plexus & right pneumogastric. Descends into mesentery, presenting numerous ganglia at its upper part, and gives off plexuses:

Inferior pancreatico-duodenal, ileo-colic, right colic, middle colic, and twigs to small intestine which divide & anastomose like the arteries, but with less regularity, and reach intestine along its attached border.

Suprarenal Plexus – From semilunar ganglia, splanchnic & phrenic nerves; presents the *ganglion suprarenale.* – The suprarenal capsules receive also a few twigs directly from phrenic & renal plexuses.

Renal Plexus – From splanchnic nerves, especially the least, solar & aortic plexuses. Gives off a few twigs to suprarenal capsule, & on right side to inferior vena cava, and forms greater part of spermatic plexus.

Spermatic Plexus (Ovarian Plexus in Female) – Mainly derived from renal plexus and also to some extent from the aortic. Accompanies spermatic or ovarian artery to testis, or to ovary & fundus of uterus.

NFERIOR ABDOMINAL & PELVIC PLEXUSES.

AORTIC or LUMBO-AORTIC PLEXUS

Is situated upon sides & front of aorta between superior & inferior mesenteric arteries.
Is derived mainly from the solar & renal plexuses and semilunar ganglia, but partly also from the lumbar ganglia. It often presents a few small ganglionic masses.
It gives off the inferior mesenteric plexus, part of the spermatic, & filaments to the inferior vena cava, and is continued below into the hypogastric plexus.

Inferior Mesenteric Plexus – Mainly derived from left side of the aortic. Accompanies trunk & branches of inf. mesenteric artery, giving off plexuses:

Left Colic, Sigmoid, & Superior Hæmorrhoidal, – Which latter plexus joins with inferior hæmorrhoidal offset of pelvic plexus.

HYPOGASTRIC PLEXUS

Is a flattened plexiform mass which lies between the two common iliac arteries in front of last lumbar vertebra, & promontory of sacrum.
Is derived from the aortic plexus & lumbar ganglia. Rarely presents any ganglia of its own.
Inferiorly it divides into the two pelvic plexuses.

PELVIC PLEXUSES (Sometimes called Inferior Hypogastric Plexuses).

Two, situated on either side of rectum in the male, of rectum & vagina in female.
Formed by bifurcation of hypogastric plexus, and by filaments from the two first sacral ganglia & four first sacral nerves, the third nerve supplying the greater number of these spinal fibres.
Sends plexiform filaments to all the pelvic viscera along branches of internal iliac artery; the ovary, however, receiving but few filaments from this source. Are thus formed the following plexuses:

Vesical – From front part of corresponding pelvic plexus. Consists of filaments rich in spinal nerve-fibres, & white in colour which are distributed to sides & base of bladder, and in the male, to vesiculæ seminales & vasa deferentia, the filaments to the vasa deferentia joining with spermatic plexus at commencement of cord.

Inferior Hæmorrhoidal – From back part of pelvic plexus; – a few small filaments, which join with superior hæmorrhoidal plexus.

Uterine – Derived mainly from upper part of pelvic plexus before addition to the latter of anterior divisions of sacral nerves. Accompanies uterine artery along side of uterus, presenting a few small ganglia, and penetrates into substance of the organ dividing into pencils of branches which anastomose but slightly with each other, and which are mainly distributed to the neck & lower part of body; some filaments are prolonged upon the Fallopian tube & round ligament. – The fundus of the uterus frequently receives a few twigs from the ovarian plexus, the ovary receiving at the same time a few filaments from the uterine.

The enlargement of the nerves of the uterus in the gravid condition is due to the thickening of their neurilemma and to the persistence of the medullary sheath, which, in the unimpregnated state, disappears soon after the nerves enter the uterus (Farre, Cleland).

Vaginal – From lower part of pelvic plexus. Contains a large proportion of spinal fibres, and supplies the mucous membrane, & the erectile tissue at anterior part of the canal.

Prostatic – From lower part of pelvic plexus. Passes forwards between prostate & levator ani, and sends a few filaments to the vesiculæ seminales. It is then prolonged into the cavernous plexus.

Cavernous – Derived from foregoing, and receives also a few filaments from pudic nerve. Gives off:

Small Cavernous Nerves – Several; perforate fibrous covering of penis near its root.

Large Cavernous Nerve – Forwards on dorsum of penis, joining with dorsal nerve, and supplies anterior part of corpora cavernosa & spongiosum.

TABLEAU of the SYMPATHETIC.

Consists of :

GANGLIA :

Prevertebral – Usually three cervical, eleven or twelve dorsal, four or five lumbar five sacral, one coccygeal. – (V. next Tablet).

Spinal – Thirty-one; lie on posterior roots of spinal nerves. – With these may be classed the Gasserian ganglion, & the ganglia near the roots of the glosso-pharyngeal & pneumogastric nerves. – (V. Cranial & Spinal Nerves).

Cranial – Four: – Ophthalmic, spheno-palatine, otic & submaxillary (V. Cranial Nerves).

Visceral – Numerous; lie in the thoraco-abdominal plexuses. – (V. these Plexuses).

BRANCHES :

Of Communication :

Between the Cranial & Prevertebral Ganglia & the Cranial Nerves. – (V. cranial nerves & cervical portion of the Sympathetic).

Between the Prevertebral Ganglia – Form with these ganglia the two grand cords of the sympathetic. – (V. next Tablet).

Between the Prevertebral Ganglia & the Spinal Nerves – Usually two for each ganglion. – (V. next Tablet).

Between the Prevertebral & Visceral and Between the Visceral Ganglia – Form with these latter ganglia the thoraco-abdominal plexuses – (V. these Plexuses).

Of Distribution – Pass through the foregoing plexuses to the thoraco-abdominal viscera, & to the arteries of the trunk & limbs.

For structure of the ganglia & sympathetic nerves – V. Structural Anatomy.

THE TEETH.

PERIODS of ERUPTION.

(FROM DENTAL CHRONOLOGY, Physiology page .)

Temporary Teeth–Appear at about the following dates, those of the lower jaw slightly [anticipating those of the upper one–:

Central Incisors–7th m. after birth.
Lateral Incisors – 9th month after birth.
First Molars – 12th month after birth.
Canines – 18th month after birth.
Second Molars – 24th month after birth.

Permanent Teeth–Appear at about the following dates, those of the lower jaw slight[ly anticipating those of the upper one:–

First Molars – 6th year.
Central Incisors – 7th year.
Lateral Incisors – 8th year.
Anterior Bicuspids – 9th year.
Posterior Bicuspids – 10th year.
Canines – 11th to 12th year.
Second Molars – 12th to 13th year.
Third Molars – 17th to 25th year.

For a year or so before the shedding of the temporary incisors, *i.e.*, between about the 5th or 6th & 7th years, there are forty-eight calcified teeth present in the jaws, namely, all the temporary teeth, and all the permanent ones except the wisdom-teeth.

THE TEETH—1st Tablet.

Temporary Set – *Twenty:* Four incisors, two canines, four molars, in each jaw.
Permanent Set – *Thirty-two:* Four incisors, two canines, four bicuspids, six molars, in each jaw.

The upper dental arch describes a wider curve than the lower one. This is due partly to the somewhat wider curve of the superior alveolar arch, and partly to the implantation of the teeth: The teeth of the upper jaw are inclined forwards in front and outwards behind; those of the lower jaw are vertical in front, and inclined slightly inwards behind.

Owing to the greater breadth of the two upper central incisors, the teeth of the upper jaw are somewhat external or posterior to those of the lower jaw: They come in contact partly with the corresponding tooth below, and partly with the one next following; the cusps of the upper molars lie a little behind the corresponding cusps of the lower molars. Since, however, the upper molars, especially the wisdom teeth, are smaller than those below, the dental arches terminate behind nearly at the same point in both jaws.

A tooth presents: –

Crown – Projecting above the gum. – The crowns diminish slightly in height from the incisors to the last molar, – those of the canines, which project beyond the level of all the other teeth, being excepted.

Root or Fang – Implanted into the alveoli. The alveolus is lined with a periosteum, the *periodental membrane,* which is continuous above with the fibrous structures of the gum.

Neck – Constricted portion between the crown and the fang.

THE TEETH—2nd Tablet.

PERMANENT TEETH.

INCISORS – Eight. Present the following peculiarities: –

Crown – Chisel-shaped; bevelled at expense of posterior surface. **Presents:**

Edge – Sharp, horizontal; presents at first three small tubercles separated two slight notch

Anterior Surface – Vertical, convex, smooth.

Posterior Surface – Oblique, concave, slightly furrowed.

Fang – Long, simple, conical, compressed from side to side, thickest from befo backwards; has sometimes a slight groove on either side, especially teeth of lower j

UPPER & LOWER Compared.

Lower – Smaller (central ones the smallest); vertical; overlapped superior or

Upper – Larger (central ones the largest); oblique; overlap inferior or fangs less compress

CANINES – Four, larger and stronger than the incisors. Present the following peculiariti

Crown – Thick & conical; tapering to a single central cusp, which rises ab level of all the other teeth; convex in front, slightly hollowed out behi

Fang – Simple, conical, longer than in any of the other teeth; compres laterally, & slightly grooved on either side; so thick from bef backwards as to cause a projection on front of alveolar ar

UPPER & LOWER Compared.

Upper *(Eye-Teeth)* – The larger and longer; lie a little external to, slightly overlap the lower or

Lower – Smaller and shorter; correspond to intervals between upper incis & upper canines; slightly overlapped by upper or

THE TEETH—3rd Tablet.

PERMANENT TEETH.

BICUSPIDS – Eight; smaller and shorter than the canines, and of about the same height as the incisors. Present the following peculiarities:

Crown – slightly compressed laterally; rounded in front & behind; surmounted by two cusps, one inner one & one outer one, of which the outer one is the largest.

Fang – Compressed laterally; deeply grooved, and has a marked tendency to become double.

UPPER & LOWER Compared.

Upper – Larger; cusps more prominent; fangs generally bifid at apex, especially in case of second bicuspid, which is frequently cleft for a considerable distance.

Lower – Smaller; cusps less prominent, especially in case of first bicuspid, the posterior cusp of which is sometimes absent.

MOLARS – Twelve; large & thick. Present the following peculiarities:

Crown – Low & cuboid; compressed from without inwards; rounded in front & behind. Grinding surface presents cusps, usually four in number (one at each angle) in the upper teeth, and five in number (two inner, three outer) in the lower teeth, separated by a more or less crucial depression.

Fangs – Multiple; more or less composite when there are but few.

THE three MOLARS Compared.

First Molar – The largest. *The upper tooth* has three fangs, two external short & divergent, one internal larger & longer, which is frequently grooved and sometimes bifid at its apex. The *lower tooth* has two broad compressed fangs, one anterior, one posterior, grooved on their contiguous surfaces.

Second Molar – Similar but somewhat smaller. The upper one is somewhat smaller than the lower one.

Third Molar – The smallest. The crown is small & rounded, and its two inner cusps are frequently blended; usually but one single composite fang, short, conical, irregularly curved. The third upper molar is a good deal smaller than the third lower one.

THE TEETH—4th Tablet.

TEMPORARY TEETH.

INCISORS & CANINES - Resemble the corresponding permanent teeth, b are smaller.

MOLARS - Present the following peculiarities: -

In both jaws, the *second* or *last molar* is much larger than the first on It is the largest of the milk-teeth; it is even larger than the second bicuspi which afterwards takes its place. - In the *lower* jaw it has five cusps, t internal, three external. In the *upper* jaw it has four cusps.

The *first upper molar* has but three cusps, two external, one internal. T *first lower molar* has four cusps.

STRUCTURE of the TEETH—1st Tablet.

Ivory or Dentine - Forming the greater part of the tooth;

Enamel - Thin layer over crown;

Cement, or Crusta Petrosa - Thin layer over fang;

Pulp - Lodged in

Pulp-cavity - In interior of dentine, shaped somewhat like tooth: Widest opposite or a little above neck; prolonged into each fang down to its apex, where it presents a small opening for entrance of vessels and nerves; also prolonged into each lateral angle of crown of incisors, & into each cusp of the bicuspids & molars.

STRUCTURE of the TEETH—2nd Tablet.

DENTINE

Resembles very compact bone both in general aspect and in chemical composition. Contains per cent.

ANIMAL MATTER, – 28, resolvable into gelatin by boiling;
EARTHY MATTER, – 72, chiefly phosphate of lime, with a little carbonat
of lime, phosphate of magnesia, fluoride of calcium, etc

Structurally it presents:

Transparent Homogeneous Solid Material, or Matrix.

Dentinal Tubules – Delicate wavy canals which radiate from the pulp-cavity toward the periphery of the tooth, and which contain minute prolongations of the superficial cells, or *odontoblasts*, of the pulp.

Towards their inner extremity their diameter is about $\frac{1}{4500}$th of an inch, an the distance between them is about two or three times their width.

As they pass outwards they divide dichotomously several times, at first withou greatly diminishing in size; and they give off numerous fine lateral branches, som of which anastomose with each other, while others end in blind extremities. Thei course is doubly undulatory: the undulations form an uninterrupted series o minute spires, the *primary undulations*, whose general direction is marked by tw or three wide and gentle curves, the *secondary undulations*. The latter undulation give rise to concentric shaded lines, *Schreyer's lines*, which must not be confounde with the incremental lines or interglobular spaces hereafter described.

Towards the periphery, both the principal tubes greatly reduced in size, an their lateral branches greatly increased in number, terminate partly in minute fre extremities, partly in loops, and partly in anastomoses either with the canaliculi o the cement or with the fissured spaces of the enamel.

The dentinal tubules are described as having a proper wall, the *dentinal sheath* probably elastic in nature. Under ordinary circumstances this wall is undistinguishable from the matrix, but it becomes visible when sections of decalcifie dentine are steeped in strong hydrochloric acid: the acid destroys the matrix bu leaves the membranous tubes intact.

In the temporary teeth the tubules are more or less moniliform or beaded.

TRUCTURE of the TEETH—3rd Tablet„

DENTINE (Continued).

Though the matrix be homogeneous in structure (Sharpey), its calcification in superimposed strata and by means of globular or spheroidal deposits *(Vide Development of the Teeth)* gives rise to

A Tendency to split into Lamellæ – This tendency becomes evident after de-calcification by the prolonged action of weak acids, or after prolonged boiling with caustic potash: The softened dentine is then easily torn into cribriform lamellæ parallel, or nearly so, to the surface of the pulp; a thin transverse section similarly treated breaks up into concentric rings like the year-rings of wood (Salter). – These lamellæ & rings mark the size & shape of the pulp-cavity during the successive stages of calcification.

Incremental Lines, Interglobular Spaces – These are dark lines of imperfect calcification separating the above lamellæ. They vary greatly in number & breadth, but are always more or less apparent in a fine longitudinal section of a fully formed tooth. Under a high power they are seen to consist of small cavities bounded by, and therefore receiving their shape from, the minute nodules or globules of dentinal deposit (Salter).

Granular Layer of Purkinje – Is a layer of small interglobular spaces which usually surrounds the fang just beneath the cement, and sometimes the crown just beneath the enamel. The more superficial of the incremental lines are continued into this layer.

STRUCTURE of the TEETH—4th Tablet.

ENAMEL.

Thickest on cutting edge or grinding surface; becomes gradually thinner near neck.

Consists of dense hard hexagonal fibres disposed perpendicularly to the surface of the cro and of about $\frac{1}{5000}$ of an inch in diameter. Their inner ends are implanted into min hexagonal depressions in the dentine. Their outer ends, somewhat larger, & free, g a tesselated appearance to the surface of the tooth.

They are striated transversely.

Their course is somewhat wavy, especially near the dentine, where they are grou in strata or ranges, which cross each other in direction, so as to give rise to the appe ance, on a longitudinal section, of lines, alternately dark & pale, radiating from the in to the outer surface of the enamel.

Numerous fine dark concentric lines termed the *coloured lines*, are also seen crossi the enamel fibres; they are of a brownish colour, but whether they are due to a depo of pigment or not is not known.

Small fissures are usually seen in the deeper parts of the enamel between the str or ranges of fibres as they pass down to the dentine; these fissures communicate w the dentinal tubules.

Enamel contains but 3·5 per cent. of animal matter, the remainder, or 96·5 per ce consisting of phosphate of lime with a little carbonate of lime, phosphate of magnes fluoride of calcium, & other salts. When submitted to the prolonged action of dil acids, the enamel is therefore almost entirely dissolved.

A delicate membrane, the *cuticle of the enamel* or *Nasmyth's membrane*, is said to co the enamel of unworn teeth, the surface of which teeeh is always crossed by more or l marked concentric ridges easily distinguishable with a common lens. This membra is of an epithelial or horny nature; it therefore withstands the action of acids

STRUCTURE of the TEETH.—5th Tablet.

CRUSTA PETROSA, or CEMENT.

A layer of true bone which surrounds the fang or fangs, being thickest at the lowe part and in the grooves of compound fangs.

Its *lacunæ* are somewhat larger and less regular than those of bone generally. In the deeper parts the *canaliculi* anastomose with the dentinal tubules; in the more superficial parts they radiate towards the periodental membrane. *Haversian canals, & lamellæ*, and *perforating fibres* (Sharpey), are found where the layer is thickest.

Its chemical composition is similar to that of ordinary bone.

There is but a small amount of cement over the fangs of the deciduous teeth. Over those of the permanent teeth the quantity increases greatly as age advances, and frequently gives rise in the aged to bony growths.

The cement is said to be very sensitive when exposed, at the neck of the tooth, through the retraction of the gum.

STRUCTURE of the TEETH.—6th Tablet.

THE PULP

Soft, vascular, sensitive.

Consists of jelly-like connective tissue with fine fibres of white fibrous tissue, cauda anastomosing nucleated cells, blood-vessels, & nerves.

The superficial cells are termed *odontoblasts.* They are elongated perpendicular to the surface of the pulp, and their superficial processes, of which several may ari from one cell, are prolonged into the dentinal tubules. They are joined to ea other by lateral processes, and to the deeper cells by radical processes. – Throug being more or less adherent to the dentine, they are sometimes described as formin the *membrana eboris.*

The *arteries* are from the inferior dental, and from the alveolar & infraorbit branches of the internal maxillary.

The *nerves* are from the inferior dental branch of the inferior maxillary division and from the anterior & posterior dental branches of the superior maxillary divisio of the fifth. Towards the surface of the pulp, they are said to end in fine non-medulated fibres which enter the dentinal tubules with the processes of the odontoblasts.

APPENDIX

TO THE

VISCERA.

THE STRUCTURE of the SALIVARY GLANDS.

Basement Membrane.

Is formed, not simply of more or less elongated epithelioid cells dovetailed one into the other, as in the case with most basement membranes, but also of branched or stellate cells. These cells form a close network with foramina here & there, rather than a perfectly continuous membrane. They are further said to send processes inwards, which processes form an inter-cellular network between the salivary cells; but whether the inter-cellular network alluded to is a sustentacular network of cell-processes (Boll), or a plexus of nerve-fibres (Pflüger), or a plexus of salivary capillaries (Saviotti), is still uncertain.

Salivary Cells.

These are of two kinds, (1) the *lining cells of the alveoli*, & (2) the *deep or half-moon-cells.*

(1) Lining Cells of the Alveoli – These are large ovoid cells, more or less flattened where they press one against another, which line, or rather almost fill up, the secreting follicles. They consist of a mass of granular photoplasm enclosing a nucleus, the position of which nucleus is a point of considerable interest. This position varies:– The nucleus is sometimes pushed outwards towards the basement membrane, sometimes drawn inwards towards the lumen.

Respecting this varying position of the nucleus, physiologists are divided into two camps; some follow the views of Pflüger, others those of Heidenhain. The former views are to the effect that, during life, the nucleus always occupies the more central position, and that its occasional displacement outwards after death is due, when it occurs, to the swelling up, through imbibition of water, of the mucus said to be frequently found in the inner part of the cell: – When through irritation of the chorda tympani, this mucus has been shed previous to death, the nucleus would be found, after death, in its normal & more central position.

The latter views are, on the contrary, to the effect that, as in case of the pancreas, the alternating displacement of the nucleus occurs during life, in coincidence with the periods of the act of secretion, which periods are marked by the appearance & disappearance of the half-moon cells described below (V. Appendix, page 40C).

(2) Deep, or half-moon Cells – These lie between the lining cells above described & the basement membrane, by pressure against which they appear to be flattened out; and they are dark & granular.

The divergence of views above alluded to with reference to the lining cells of the alveoli, continues with respect to these half-moon cells.

According to the followers of Pflüger, they appear only after death, and are due to the same post-mortem changes which press outwards the nucleus of the lining cells: – The lining cells, becoming distended, through imbibition of the mucus they contain, press outwards the smaller peripheral cells, which contain no mucus, and flatten them against the basement membrane.

According to the followers of Heidenhain, on the contrary, these cells appear & disappear alternately in coincidence with the several periods of the process of secretion.

They appear during the intervals of the periods of excretion, and correspond in function to the outer or zymogen-forming portion of the secreting cells of the pancreas. They disappear during the periods of excretion:– The granular & protoplasmic material they contain then passes into the lining cells. In support of this it is shown that these half-moon cells are granular & easily stained with carmine, while the lining cells are neither granular nor easily stained, *except for a short time after the disappearance of the half-moon cells;* then also is their nucleus pushed inwards by the granular protoplasmic & easily staining material which distends their outer portions.

Irritation of the chorda tympani brings about all the changes which characterise the period of excretion (V. Tablets on physiology, Appendix, page 36 & 38A).

Intercellular Reticulum.

An intercellular reticulum is said to surround the cells, and to enclose them on all sides. But whether this reticulum is a sustentacular network of cell-processes, or not, is still uncertain. By Pflüger, as will be seen below, it is described as consisting, in part at least, of a plexus of fine nerve-fibres. According to Saviotti, Langerhans, & others, it is a plexus of "Salivary Capillaries," *i. e.*, of minute canals communicating with the alveoli; and in support of this view it is stated that, when a salivary gland is injected from its duct, the injection matter, after filling the alveoli, passes into, and distends, these capillaries. According to Gianuzzi, it is a plexus of lymphatics.

Pfluger's Account of the Nerve-Supply.

Pflüger believes that he has been able to trace the nerve-fibres into direct continuity with the secreting cells. These nerve-fibres would terminate in one of the four following ways: –

1. – The nerve loses its sheath as it perforates the basement membrane; it then divides into smaller fibres, which run between the cells. Each of these fibres perforates the wall of a cell, and ends in its nucleus.

2. – Some of the nerves terminate upon the cells in a kind of expansion or foot, the so-called "protoplasm foot," whose substance is intermediate in nature between glandular tissue and nervous tissue.

3. – The bases of the cells which line the ducts present a varicose prolongation which perforates the basement membrane, and becomes continuous with several nerve-fibres. These pass up towards the nucleus, giving rise to the striæ which mark the peripheral portion of the cell.

4. – Sympathetic nerve-fibres terminate in multipolar ganglion-cells, the caudate, offsets of which penetrate into the glandular cells, and end in their nucleus.

By most physiologists, this account has not been favourably received.

Epithelium of the Ducts.

In the very smallest ducts, *i. e.*, in those which are continued from the alveoli, there is a single layer of slighly flattened spheroidal epithelium. In the ducts a little larger, the epithelium suddenly becomes columnar, or rather conical or pyramidal: the smaller ends of the cells are turned towards the lumen, and are homogeneous or granular; their larger ends are turned towards the basement membrane, and are slightly striated vertically. As above stated, this striation is due, according to Pflüger, to fine nerve-fibres passing up towards the nucleus. In the largest ducts, the epithelium becomes tesselated; and a few white, yellow elastic, & muscular fibres surround the basement membrane externally.

Lymphatics.

The lymphatics are described as commencing in fissures between & around the alveoli (Gianuzzi).

THE TONGUE — 2nd Tablet.

MUSCULAR FIBRES

Form extrinsic & intrinsic muscles.

EXTRINSIC MUSCLES

Are the:

Stylo-glossus – Anterior & outer aspect of styloid process near its apex & stylo-maxillary ligament.

Side of base of tongue externally to hyo-glossus, dividing into:

Longitudinal portion – Forwards along side of tongue, and blends with lingualis inferior in front of hyo-glossus.

Transverse portion – Decussates with hyo-glossus & with its fellow.

Hyo-glossus – Side of body, lesser cornu & whole length of great cornu of hyoid bone (basio-glossus, chondro-glossus, cerato-glossus).

Side of under surface of tongue between stylo-glossus & lingualis inferior.

Genio-hyo-glossus – By a short tendon from superior genial tubercle on inner surface of body of jaw-bone close to symphysis.

Whole length of under surface of tongue internally to lingualis inferior, side of pharynx, body of hyoid bone.

Palato-glossus or **Constrictor Isthmi Faucium** – Anterior surface of soft palate close to uvula.

Side of base of tongue, blending with stylo-glossus.

INTRINSIC MUSCLES

Are the:

Lingualis transversus – Median septum.

Sides, and sides of dorsum. – Forms the chief bulk of the tongue.

Lingualis Superior – Stratum of longitudinal or slightly oblique fibres thickest in front, and covering dorsum of tongue beneath the mucous membrane to which the individual fibres are attached.

Lingualis Inferior – Longitudinal band of fibres along whole length of under surface of tongue between hyo-glossus & genio-hyo-glossus.

Blends with stylo-glossus in front of hyo-glossus.

Lingualis Perpendicularis – Set of vertical or slightly oblique fibres from central part of dorsum to sides of under surface, forming curves concave upwards & outwards.

The outer parts, or cortex, of the tongue are firm, and consist mainly of longitudinal fibres; the central part, or nucleus, is softer, and consists mainly of transverse & vertical fibres intermingled with adipose tissue.

THE TONGUE — 3rd Tablet.

MUCOUS MEMBRANE.

Thick & rough on anterior two-thirds of dorsum, sides, & tip; thin & smooth on posterior third of dorsum & on under surface.

Consists of a cutis or corium dense & very similar to that of the skin, and of a thick layer of squamous epithelium; and presents:

PAPILLÆ — Highly sensitive vascular projections divisible into simple and compound. The former are similar to the papillæ of the skin, and cover whole of tongue; the latter, which are themselves studded with simple papillæ, are found on rough surface only, and are divided according to their size & shape into:

Papillæ Maximæ or Circumvallatæ – From 7 to 12; situated at junction of middle & posterior thirds of dorsum, where they are arranged in two rows oblique backwards & inwards, which rows meet at foramen cœcum and form together an inverted V. They consist of a central conical projection, the base of which is free while its apex is attached, which projection is contained in a cup-shaped depression bounded itself by a prominent circular rim. – The foramen cœcum is the central depression, usually large, which lodges the central papilla, itself frequently small.

Papillæ Mediæ or Fungiformes – Club-shaped, and present narrow attached & rounded free extremities. Sparingly scattered over anterior two-thirds of dorsum, collected in greater numbers over sides & tip.

Papillæ Minimæ, or Conicæ et Filiformes – Tapering or cylindrical, closely packed over whole of rough surface, and arranged in rows which are vertical on borders & tip, and which are, on dorsum, parallel, posteriorly, to the rows of circumvallate papillæ, but, anteriorly, more directly transverse. – The simple or secondary papillæ borne by the filiform papillæ contain a few elastic fibres, and their epithelial sheaths are prolonged beyond them sometimes to the extent of forming a pencil of almost hair-like fibres.

In the fungiform & circumvallate, and probably also in the filiform papillæ, the nerves form plexuses, from which small brush-like filaments are given off to the secondary papillæ. These filaments are believed to terminate in the deep extremities of spindle-shaped nucleated bodies similar to the olfactory cells of Schultze (Billroth, Key).

GLANDS — Are:

Follicular – Aggregated on posterior third of dorsum behind papillæ circumvallatæ, and very similar to the follicular recesses of the tonsils.

Racemose – Lie beneath & in front of foregoing, and over sides & under surface of tongue. On under surface near tip they are collected into two small oblong masses first described by Blandin & Nuhn.

THE STRUCTURE of the LIVER.

Biliary Capillaries

Commence between & around the individual cells in a network much finer & closer tha that of the blood-capillaries. The vessels which form this network can be seen under hig powers as minute apertures between the flattened contiguous sides of adjacent hepatic cells, bu they can scarcely be injected except through Chrzonszczewsky's method of "natural injec tion," which is as follows: – A solution of sulph-indigotate of soda is injected into th internal jugular vein of a living animal (dog or sucking-pig), and the animal is killed shortl afterwards. The blue colouring matter is then seen to have penetrated, according to the tim the animal was allowed to live after the injection, first into the vessels of the liver, then int the hepatic cells, and finally into the biliary capillaries.

It is believed that these capillaries have a proper wall of their own, though this wall ha not yet been demonstrated. They open into a fine intralobular plexus, the walls of which plexus a formed of an incomplete basement membrane lined with short polygonal cells which nearly fill t the lumen. The succeeding interlobular plexus presents a complete basement membrane line [with columnar cell

The Larger Bile-ducts.

The larger ducts contained in the portal canals have strong & distensible areolar coa containing a good deal of elastic tissue, and, in the largest ducts, a few plain muscular fibre The largest ducts are beset with true mucous glands; but, in addition to these glands, both the largest ducts, & those that are somewhat smaller, present numerous cæcal recesses believed at o time to be glandular. Some of these recesses are saccular in form; others are tubular; some a branched; some form an anastomosing network beset with smaller dilatations; and the dilatations are sometimes so numerous that they partly conceal the parent trunk. Hence t belief, once entertained by Henle & others, that it is these recesses, and not the hepatic cells, that a [engaged in the secretion of the bi

The Hepatic Artery.

Within the portal canals, the divisions of the hepatic artery give off three sets of branch *capsular, vaginal, & interlobular.* The *capsular* branches spread out under the fibrous coat, whi they supply. The *vaginal* branches ramify within the portal canals, and supply Glisso capsule and the walls of the blood-vessels & bile-ducts. The *interlobular* branches pass between the lobules, in company with the interlobular branches of the portal vein, which branc are much larger than they. They supply that part of the capillary network of the lobul which is intermediate between the branches of distribution of the portal vein & the branches of orig of the hepatic veins, *i.e.,* between the lobular branches of the portal vein & the intralobu hepatic veins. This is shown by the results of post-mortem examinations in cases of *active* co gestion of the liver, and by the results of Chrzonszczewsky's "natural injections" in anim whose *portal vein* has been tied: in both cases the lobules are stained in their central part (with blo [or injection matter, as the case may be), while their peripheral part is pa

The Portal Vein.

Within the portal canals, the divisions of the portal vein *receive* capsular & vaginal branch which return the blood distributed to the liver by the corresponding brs. of the hepatic arte

The branches of distribution of the portal vein, *i.e.,* the *interlobular* & the *lobular,* have alre been described, page 314, the former as passing out between the lobules, the latter as penetr ing into the lobules and forming a plexus within their peripheral part. This is shown by results of post-mortem examinations in cases of *portal* congestion, and by the results of Chrzo czewsky's "natural injections" in animals whose *hepatic* artery has been tied: in both ca the lobules are stained in their peripheral part (with blood or injection matter, as the case may while their central part is pale. – From the plexus within the lobules arise the *intralobular* hepa [veins, already described with the sublobular & the larger hepatic veins. V. page

Hepatic Veins.

The minute intralobular veins appear to open at once into the sides of the adjacent sul bular veins, which latter have very thin walls, and are closely adherent to the lobules. larger hepatic veins run alone, and have no intralobular veins opening directly into them. Th walls are somewhat thicker, but they are still separated from the lobules by only a very thin la of cellular tissue: when any of the hepatic veins are divided their mouths remain open.

Capillary Plexus.

The capillary plexus of the liver is an exceedingly close one. Its vessels are large, ($\frac{1}{250}$ an inch), and the spaces between them do not exceed the diameter of one or two of the hep cells. These vessels converge from the branches of distribution of the portal vein to the branc of origin of the hepatic veins, *i.e.,* from the lobular branches of the portal vein to the intralob hepatic veins. They are not in immediate contact with the hepatic cells, but are separ from them by a narrow space lined with flatttened cells, which space serves for the passag lymph. In the human subject, owing to the imperfect isolation of the lobules, the capil [plexus appears continuous here & there from one lobule to anot

The Lymphatics

Originate in the above mentioned spaces around the capillaries. A few lymphoid nod are connected with them. They take the course already described, page 314.

Hepatic Cells.

The hepatic cells are arranged in a network radiating from the centre of the lobules to periphery, the openings of which network are all but completely occupied by the bl capillaries. Their diameter varies from $\frac{1}{1000}$ to $\frac{1}{850}$ of an inch. They have no cell wall. – V. p.

THE STRUCTURE of the SPLEEN.

Trabecular Framework.

Consists not only of the fibro-elastic coat with the sheaths of the vessels & the larger trabeculæ hitherto described (V. page 317), but also of a delicate network of retiform tissue which pervades & supports the pulp. This network consists of branched connective-tissue corpuscles, the *supporting cells of the pulp* (Schäfer), which are joined together by their processes. When they are well developed, these supporting cells may contain either pigment granules resulting from the disintegration of the blood-corpuscles, or even entire corpuscles more or less altered in form & colour. But they are frequently reduced in size; and occasionally they have entirely disappeared, leaving only a reticulum of simple fibres.

Small Arteries, Capillaries, & Small Veins.

In the spleen, these are modified as follows: –

1. – The small arteries lose their external coat; or rather this coat becomes transformed into a stratum of lymphoid tissue expanded here & there into small spheroidal masses, the *Malpighian Corpuscles (Vide below).*

2. – The cells which form the walls of the capillaries, become transformed into connective tissue corpuscles. In the largest capillaries, these corpuscles are closely packed & imbricated. In those a little smaller, they form but a single layer, and are merely joined edge to edge. Further on, they cease to lie in immediate contact, and are connected one to another merely by processes of varying & increasing length. The capillaries thus become first fenestrated, then more & more deficient in continuous parietes; and finally, losing their tubular character entirely, they merge into the retiform network of the pulp, and cease to exist as distinct vessels.

Thus the arterial capillaries open directly into the areolar spaces. From these spaces the venous capillaries arise in the same way in which the arterial capillaries end.

The small veins frequently present transverse markings, which are probably due to the arrangement of the retiform tissue on their surface. They run apart from the small arteries, which are disposed in *tufts* or *pencils*. They anastomose freely with each other, while the arteries anastomose but very little (V. page 317).

Malpighian Corpuscles.

These are localised expansions, or thickenings, of the lymphoid tissue above described as forming the outer coat of the small arteries. They vary in size up to $\frac{1}{25}$ of an inch, their average diameter being about $\frac{1}{60}$ or $\frac{1}{70}$ of an inch. The larger ones are clearly visible to the naked eye, and appear, on a fresh section, as pale coloured spots on the dark background of the pulp. They are more or less spheroidal in shape. In the lower mammalia, they are usually placed either on one side only of the arterial wall, or in the angle of separation between two arteries. In man, they are mostly developed all round the vessel, generally a small one, which then penetrates their substance, and by which they are suspended, so to speak, from a larger trunk. Their reticulum is very slender & open, especially towards the centre, where it is also most densely packed with lymphoid corpuscles and most abundantly supplied with capillaries. Towards the periphery, the reticulum becomes a little closer; no distinct boundary exists, however, between the corpuscle & the surrounding pulp.

"Taste-Buds."

Are flask-like bodies discovered by Loven & Schwalbe in the thick epithelial layer which surrounds the sides of the circumvallate papillæ of the base of the tongue, and which have also been found of late on some of the fungiform papillæ and on the epiglottis. They are pyriform in shape. Their bases rest upon the chorium. Their apices project between the superficial epithelial cells, and present a minute opening, from which a bundle of thread-like processes are seen to emerge.

They consist of modified epithelial cells, disposed perpendicularly to the surface, which cells may be divided into superficial & deep. The *superficial cells* are flattened, or ribbon-like tapering at each end, and joined together at their sides, so as to enclose the deeper cells, as, in the flower-bud, the external scales surround the internal folioles. The *deeper cells* are spindle-shaped, enlarged in their middle, where they present a prominent nucleus, and tapering at eithe end. Their deeper end, which is sometimes branched, passes down into the chorium, and, it is said, becomes connected with a nerve-fibril. Their more superficial end is prolonged into one of the thread-like processes, which are seen to project from the opening of the taste-bud. The surrounding epithelial cells are flattened round the taste-buds, so to enclose them in a sac or nest.

The taste-buds are now believed not to be connected with the sense of taste, since they are found on the epiglottis, which is not endowed with taste.

Follicular Recesses of the Tonsils, & of the Base of the Tongue.

Beneath the mucous covering of these organs are found, not closed follicles, as was formerly stated, but closely packed nodular masses of retiform or lymphoid tissue (V. Structura Anatomy).

Deville's Gland,

Dr. Deville has demonstrated the existence beneath the [mucous membrane of the unde surface of the tongue, not far from the tip, of a large racemose horse-shoe-shaped glandular mass stretching across the middle line, with its convexity in front & its concavity behind.

Mucous Membrane of the Pharynx.

In addition to the simple & compound follicular and racemose glands described, page 299 there exist numerous lymphoid follicles, or masses of reticular or lymphoid tissue similar t those of the intestine. A collection of these masses stretches across the back of the pharyn between the Eustachian tubes.

Mucous Membrane of the Soft Palate.

In the fœtus, the mucous membrane over the whole of the posterior surface of the sof palate is covered with columnar ciliated epithelium; and, in many instances, the epithelium o the gland-ducts retains this character. Except near the Eustachian tubes, the surface epithelium subsequently becomes squamous.

Mucous Membrane, & Muscular Coat of the Œsophagus.

A thin layer of plain muscular fibres disposed longitudinally *(muscularis mucosæ)* bound externally the mucous membrane of the lower part of the œsophagus, and is continued inferiorl into the corresponding but better developed structure of the mucous membrane of th stomach.

The blood-vessels are mostly longitudinal in direction. Lymphatics and a little lympho tissue are found both in the mucous & sub-mucous coats. The nerves form gangliated plexus between the two layers of the muscular coat.

THE DIGESTIVE ORGANS.

THE TONSILS.

Rounded, slightly elongated from above downwards, & rather variable in size; lie in rece between anterior & posterior pillars of soft palate, and correspond to angle of ja Presen

Outer Surface – In contact with superior constrictor of pharnyx, which separates it fro internal carotid & ascending pharyngeal arterie

Inner Surface – Forms part of lateral boundary of isthmus faucium, and presents t openings, from twelve to fifteen in number, of large recesses, from which small recesses or follicular depressions branch out into the substance of the glan These recesses & follicular depressions are lined by a continuation of the muco membrane & of the epithelial layer of the throat. Their walls are thick, a consist mainly of a layer of closed capsules, similar to those of Payer's patch and imbedded in the submucous tissu

Vessels & Nerves – Arteries. Ascending & descending palatine, dorsalis lingu ascending pharyngeal. – Veins. Open into tonsillar plexus on outer si of tonsil. – Nerves from fifth & glosso-pharynge

THE TONGUE — 1st Tablet.

Presents for examination:

BASE – Connected to:

Soft palate – By anterior pillars of fauces;
Pharynx – By superior constrictors of pharynx & mucous membrane;
Epiglottis – By three folds of mucous membrane, the glosso-epiglottic ligaments;
Hyoid bone – By hyo-glossi & genio-hyo-glossi muscles.

APEX – Free.

UPPER SURFACE OR DORSUM — Rough in its anterior two-thirds, where it presents the *papillæ minimæ* or *conicæ et filiformes*, and the papillæ *mediæ* or *fungiformes*; smooth in its posterior third, or behind the papillæ *maximæ* or *circumvallatæ*, where it presents the projecting orifices of nnmerous mucous glands.

UNDER SURFACE — Connected to hyoid bone & lower jaw by hyo-glossi & genio-hyo-glossi muscles, and from sides of which the mucous membrane is reflected over floor of mouth to inner surface of gums, forming in front a prominent fold, the frænum linguæ.

STRUCTURE of the TONGUE

Presents for examination:

Osteo-fibrous Support – Consists of:

HYOID BONE;
MEDIAN FIBROUS SEPTUM – Thickest behind, where it is attached to epiglottis.
HYO-GLOSSAL MEMBRANE – Connects under surface of tongue to hyoid bone. To these may be added the
THICK MUCOUS MEMBRANE ON THE DORSUM OF THE ORGAN.

Muscular fibres – Vide next Tablet.

Mucous Membrane – Vide next Tablet but one.

Vessels & Nerves.

ARTERIES – *Lingual*, inferior or ascending palatine branches of *facial*, *ascending pharyngeal.*
VEINS – Partly correspond to arteries, partly open into pterygoid plexus.
LYMPHATICS – To submaxillary glands.
NERVES – Are the:

Gustatory to mucous membrane of anterior two-thirds, & sides;
Glosso-pharyngeal to mucous membrane of posterior third or base;
Hypoglossal to the muscles.

Internal branch of the superior laryngeal sends a few twigs to mucous membrane of base. — A few small ganglia are found (Kölliker, Remak) upon the glosso-pharyngeal and, in the sheep & calf, upon the gustatory.

THE TONGUE – 2nd Tablet.

MUSCULAR FIBRES

Form extrinsic & intrinsic muscles.

EXTRINSIC MUSCLES

Are the:

Stylo-glossus - Anterior & outer aspect of styloid process near its apex & styl maxillary ligamen

Side of base of tongue externally to hyo-glossus, dividing into:

LONGITUDINAL PORTION - Forwards along side of tongue, and blends wi lingualis inferior in front of hyo-gloss

TRANSVERSE PORTION - Decussates with hyo-glossus & with its fellow.

Hyo-glossus - Side of body, lesser cornu & whole length of great cornu of hyo bone (basio-glossus, chondro-glossus, cerato-glossus

Side of under surface of tongue between stylo-glossus & lingua inferi

Genio-hyo-glossus - By a short tendon from superior genial tubercle inner surface of body of jaw-bone close to symphys

Whole length of under surface of tongue internally to lingualis i ferior, side of pharynx, body of hyoid bon

Palato-glossus or **Constrictor Isthmi Faucium** - Anterior surface soft palate close to uvul

Side of base of tongue, blending with stylo-glossus.

INTRINSIC MUSCLES

Are the:

Lingualis transversus - Median septum.

Sides, and sides of dorsum. - Forms the chief bulk of the tongue.

Lingualis Superior - Stratum of longitudinal or slightly oblique fibres thicke in front, and covering dorsum of tongue beneath the mucou membrane to which the individual fibres are attache

Lingualis Inferior - Longitudinal band of fibres along whole length of und surface of tongue between hyo-glossus & genio-hyo-glossus.

Blends with stylo-glossus in front of hyo-glossus.

Lingualis Perpendicularis - Set of vertical or slightly oblique fibres fro central part of dorsum to sides of under surface, forming curv concave upwards & outward

The outer parts, or cortex, of the tongue are firm, and consist mainly longitudinal fibres; the central part, or nucleus, is softer, an consists mainly of transverse & vertical fibres intermingled wi adipose tissu

THE TONGUE – 3rd Tablet,

MUCOUS MEMBRANE.

Thick & rough on anterior two-thirds of dorsum, sides, & tip; thin & smooth on posterior third of dorsum & on under surface.

Consists of a cutis or corium dense & very similar to that of the skin, and of a thick layer of squamous epithelium; and presents:

PAPILLÆ – Highly sensitive vascular projections divisible into simple and compound. The former are similar to the papillæ of the skin, and cover whole of tongue; the latter, which are themselves studded with simple papillæ, are found on rough surface only, and are divided according to their size & shape into:

Papillæ Maximæ or Circumvallatæ - From 7 to 12; situated at junction of middle & posterior thirds of dorsum, where they are arranged in two rows oblique backwards & inwards, which rows meet at foramen cæcum and form together an inverted V. They consist of a central conical projection, the base of which is free while its apex is attached, which projection is contained in a cup-shaped depression bounded itself by a prominent circular rim. - The foramen cæcum is the central depression, usually large, which lodges the central papilla, itself frequently small.

Papillæ Mediæ or Fungiformes - Club-shaped, and present narrow attached & rounded free extremities. Sparingly scattered over anterior two-thirds of dorsum, collected in greater numbers over sides & tip.

Papillæ Minimæ, or Conicæ et Filiformes - Tapering or cylindrical, closely packed over whole of rough surface, and arranged in rows which are vertical on borders & tip, and which are, on dorsum, parallel, posteriorly, to the rows of circumvallate papillæ, but, anteriorly, more directly transverse. - The simple or secondary papillæ borne by the filiform papillæ contain a few elastic fibres, and their epithelial sheaths are prolonged beyond them sometimes to the extent of forming a pencil of almost hair-like fibres.

In the fungiform & circumvallate, and probably also in the filiform papillæ, the nerves form plexuses, from which small brush-like filaments are given off to the secondary papillæ. These filaments are believed to terminate in the deep extremities of spindle-shaped nucleated bodies similar to the olfactory cells of Schultze (Billroth, Key).

GLANDS – Are:

Follicular - Aggregated on posterior third of dorsum behind papillæ circumvallatæ, and very similar to the follicular recesses of the tonsils.

Racemose - Lie beneath & in front of foregoing, and over sides & under surface of tongue. On under surface near tip they are collected into two small oblong masses first described by Blandin & Nuhn.

THE SALIVARY GLANDS—1st Tablet.

Are the parotid, submaxillary & sublingual, and numerous smaller glands situated beneath the mucous membrane of the mouth. They are all conglomerate or racemose glands.

PAROTID GLAND

Lies below & in front of external ear, and stretches forwards to a variable extent on outer surface of masseter, often presenting in that situation and just below zygoma, a small detached portion, the socia parotidis.

Is bounded by:

Above - Zygoma.
Below - Line drawn from angle of jaw to sterno-mastoid.
Behind - External auditory meatus, mastoid process, sterno-mastoid, posterior belly of digastric.

Presents:

Outer Surface - Lobulated. Covered by integument, fascia & a few fibres of platysma.
Inner Surface - Prolonged deeply in front of and behind styloid process towards internal carotid & internal jugular vein, wall of pharynx & deep part of glenoid fossa.
Ant. Surface - Grooved externally for posterior border of ramus, and prolonged forwards, internally, between the two pterygoid muscles.
Post. Surface - Rests upon external auditory meatus, mastoid process, sterno-mastoid, posterior belly of digastric.

Is perforated by several

Arteries - *External carotid* with its *posterior auricular*, *internal maxillary* & *temporal* branches, and the *transverse facial* offset of the latter.
Veins - *Internal maxillary* & *temporal* forming origin of *external jugular*, and a *branch of communication* between the latter & the internal jugular.
Nerves - *Facial*, *auriculo-temporal* & deep facial branches of *great auricular*.

ITS VESSELS & NERVES are — Arteries & Veins, from or to above mentioned trunks. - Lymphatics, to two or three lymphatic glands in substance & on surface of parotid, and from thence to superficial & deep glands of neck. - Nerves, from carotid plexus, auriculo-temporal & great auricular.

PAROTID DUCT (Steno's or Stenson's) — From anterior border of the gland, and from socia parotidis when it exists. Over masseter a finger's breadth below zygoma, its direction being marked by a line from lower part of concha to midway between free margin of the lip & ala of the nose. Through fat of cheek & buccinator, and obliquely beneath mucous membrane, which it perforates opposite 2nd molar tooth of upper jaw.

HE SALIVARY GLANDS—2nd Tablet.

SUBMAXILLARY GLAND

Intermediate in size between parotid & sublingual. Presents two portions:

Superficial Portion – The largest.

Covered by – Skin, superficial fascia, platysma, deep fascia, body of lower jaw.
Rests upon – Stylo- & hyo-glossi & mylo-hyoid.
Separated posteriorly from parotid by – Stylo-maxillary ligament.
Grooved posteriorly & above by – Facial artery.

Deep Portion – The smallest.

Prolonged upwards forwards & inwards round Wharton's duct, between mylo-hyoid and hyo- & genio-hyo-glossi & below gustatory nerve.

WHARTON'S DUCT — Upwards forwards & inwards with deep portion of the gland on inner side of sublingual gland, and opens on summit of a small papilla on side of frænum linguæ. Is about 2 inches long, and has much thinner walls than Steno's duct; it receives a few of the ductus Riviniani.

Vessels & Nerves – *Arteries*, from facial & lingual. – *Nerves*, from submaxillary ganglion, sympathetic & mylo-hyoid branch of inferior dental.

SUBLINGUAL GLAND

The smallest, flattened, & almond-shaped.

Projects beneath mucous membrane of floor of mouth in the shape of a firm antero-posterior crest.
Lies upon mylo-hyoid by side of frænum linguæ & in sublingual fossa of lower jaw.
Has behind it & on its inner side genio-hyo-glossus, gustatory nerve, Wharton's duct & deep portion of submaxillary gland.

DUCTUS RIVINIANI — From 8 to 20. Open most of them directly into the mouth, some into Wharton's duct. One, longer than the others, the duct of Bartholin, which is sometimes derived in part from submaxillary gland, accompanies the Whartonian duct, and opens into it or near it on floor of mouth.

Vessels & Nerves – *Arteries*, from sublingual & submental branches of facial. – *Nerves*, from gustatory.

THE PHARYNX

Is a musculo-membranous bag extending from base of skull to lower border of cricoid ca tilage in front & 5th cervical vertebra behind; about 4½ inches long; broadest fro side to side, its greatest breadth being comprised between cornua of hyoid bor

It is bounded above by petrous portion of temporal bone and by under surface of body sphenoid; – not, as has hitherto been stated, by basilar process of occipital, the rec capitis antici muscles passing forwards between roof of pharynx & whole length that process (Thomson & Cleland

It is continuous below with œsophagus.

It is connected behind by loose areolar tissue to the cervical vertebræ & the longi colli recti capitis antici muscle

In front it is attached from above downwards to:

Internal pterygoid plate;
Pterygo-maxillary ligament;
Lower jaw;
Base of tongue;
Cornua of hyoid bone & stylo-hyoid ligament;
Thyroid & cricoid cartilages.

Laterally it is in relation with styloid process, styloid & pterygoid muscles, internal carot artery, internal jugular vein, glosso-pharyngeal, pneumogastric, spinal accessor hypoglossal & sympathetic nerves; and also, below, with lateral lobes of thyroid glan common carotid artery & sterno-hyoid, and, in front, with hyo-glossus muscle ar lingual artery & nerv

It presents seven openings: – nares, Eustachian tubes, mouth, larynx, œsophagus.

STRUCTURE of the PHARYNX

Presents three coats, which, from without inwards, are muscular, fibrous, mucous; and vessels & nerves.

MUSCULAR COAT — Is formed by:

Inferior Constrictor – Side of cricoid cartilage; oblique line on outer surface of ala of thyroid cartilage & surface behind it, and inferior cornu.

Raphé on posterior median line of pharynx; its inferior fibres being horizontal & continuous with those of œsophagus, and its superior fibres passing obliquely upwards and overlapping those of the middle constrictor. – S. by pharyngeal plexus and external & recurrent laryngeal nerves.

Middle Constrictor – Whole extent of upper surface of great cornu of hyoid bone, lesser cornu, stylo-hyoid ligament.

Raphé on posterior median line of pharynx; its inferior fibres descending beneath inferior constrictor, its middle fibres being horizontal, and its superior fibres overlapping superior constrictor & stylo-pharyngens. – S. by pharyngeal plexus.

Superior Constrictor – Lower third of free margin of internal pterygoid plate, its hamular process, & contiguous part of palate bone; pterygo-maxillary ligament; alveolar process of inferior maxilla above mylo-hyoid ridge; side of tongue.

Raphé on posterior median line of pharynx; its superior fibres ascending by means of strong fibrous band below mentioned, to pharyngeal spine on basilar process, its lower fibres being horizontal. – S. by pharyngeal plexus.

Stylo-pharyngeus – Inner side of base of styloid process.

With palato-pharyngeus into posterior border of thyroid cartilage & side of pharynx. – S. by pharyngeal plexus & glosso-pharyngeal nerve.

Palato-pharyngeus – Posterior surface of soft palate by two heads separated by levator palati.

With stylo-pharyngeus into posterior border of thyroid cartilage & side of pharynx. – S. by pharyngeal plexus.

Salpingo-pharyngeus (Santorini) – Small fasciculus from outer surface of cartilaginous portion of Eustachian tube to stylo-pharyngeus, with which it blends inferiorly. Is often wanting.

Other accessory muscles, the petro-, spheno-, & occipito-pharyngei, are also described; but they are rarely met with.

Relations – The constrictors overlap each other from below upwards. The stylo-pharyngeus passes between superior & middle constrictors; the superior laryngeal nerve between the middle & inferior constrictors; the recurrent laryngeal nerve beneath the inferior. – (Vide also relations of pharynx in foregoing Tablet).

FIBROUS COAT, or PHARYNGEAL APONEUROSIS — Thick above, thin below. Attached to petrous portion of temporal bone, under surface of body of sphenoid, and, by means of a strong fibrous band (cranio-pharyngeal ligament, Thomson & Cleland), to pharyngeal spine on under surface of basilar process.

MUCOUS MEMBRANE — Thick on under surface of body of sphenoid; covered with columnar ciliated epithelium as low down as floor of nares, with squamous epithelium below. Beneath it are found numerous glands, which are simple & compound follicular and racemose.

VESSELS & NERVES — Arteries. Ascending pharyngeal, pterygo-palatine, superior or descending palatine, superior thyroid. – Veins. Open into the superior thyroid & internal jugular. – Lymphatics. Open into deep glands of neck. – Nerves. From pharyngeal plexus, and from external & recurrent laryngeal nerves.

THE SOFT PALATE.

Musculo-membranous fold, which forms an incomplete septum between the mouth a pharynx. Present

Anterior Surface – Concave; presents a median raphé, continuous with that of hard palat

Posterior Surface – Convex, continuous with floor of nasal fossæ; presents the median p jection of the azygos uvulæ.

Upper Border – Attached to posterior border of hard palate.

Lower Border – Free; presents the uvula and the anterior & posterior pillars, which t latter embrace the tonsil.

Anterior Pillars – Downwards & forwards to sides of base of tongue; contain pala glossi muscles.

Posterior Pillars – Downwards & backwards to sides of pharynx; contain pala pharyngei muscles Are rather broader and approach nearer to each ot than the anterior.

Isthmus Faucium – Is the space bounded by the free border & pillars of the s palate, the tonsils, and the base of the tongue.

STRUCTURE of the SOFT PALATE

Presents for examination:

APONEUROSIS — Blended with tendon of tensor palati. Is thickest above, wh it is attached to posterior border of hard palate.

MUSCLES — Five on each side:

Levator Palati – Under surface of apex of petrous portion of temporal b and outer aspect of cartilaginous portion of Eustachian tube.

Posterior surface of soft palate between the two heads of origin palato-pharyngeus. – S. by post. or small palatine branch from Meckell's

Tensor or Circumflexus Palati – Scaphoid fossa at base of internal pte goid plate; spine of sphenoid; anterior aspect of cartilaginous portion Eustachian tube.

Winds round hamular process and expands upon anterior surface aponeurosis of soft palate. – S. by a branch from otic ganglion.

Palato-glossus – Anterior surface of soft palate.

Posterior part of side of tongue, where it blends with stylo-glossus.

Palato-pharyngeus – Posterior surface of soft palate by two heads separat by the levator palati.

Posterior border of thyroid cartilage & sides of pharynx.

Azygos Uvulæ – Posterior nasal spine of palate bone & aponeurosis of s palate.

Uvula. – S. by posterior or small palatine branch from Meckell's gan

MUCOUS MEMBRANE — Thin; covered with squamous epithelium, except ne Eustachian tube, where the epithelium is columnar & ciliated. Numer mucous glands are found beneath it, especially over posterior surface uvula, in which latter situations they form a continuous layer.

VESSELS & NERVES — Arteries. Inferior or ascending palatine, posterior descending palatine, ascending pharyngeal, dorsalis linguæ, tonsillar. Veins. Join the tonsillar & pterygoid plexuses. – Lymphatics. To glan beneath angle of jaw. – Nerves. From fifth, facial & glosso-pharyngeal.

HE ŒSOPHAGUS

Commences in middle line of neck opposite 5th cervical vertebra & lower border of cricoid cartilage.

Downwards & to the left behind trachea, left lobe of thyroid gland & left recurrent laryngeal nerve, coming into close contact with left common carotid.

Downwards & to the right behind lower end of trachea & commencement of left bronchus, and between arch of aorta & thoracic duct on the left & the vena azygos major on the right, regaining middle line opposite 5th dorsal vertebra.

Again to the left between heart & pericardium in front and lower part of thoracic aorta behind, being surrounded by the pneumogastrics, which tend, the left one to the front, the right one to the back.

Through œsophageal opening of diaphragm, and opens into stomach (cardiac or œsophageal opening) opposite 9th dorsal vertebra.

Is from 9 to 10 inches long.

STRUCTURE.

Three coats:

Muscular Coat – Thicker than in any other part of intestinal canal except lower end of rectum; red above, where it consists of striped muscular fibres, pale below, where it is made up mainly of plain fibres. These fibres are:

External Longitudinal – Above they form three fasciculi:

One anterior – From ridge on back of cricoid cartilage;

Two Lateral – From sides of cricoid cartilage, blending with inferior constrictor.

Below they form a uniform layer, and become continuous with longitudinal fibres of muscular coat of stomach. – One or two bundles of fibres are sometimes inserted into the left pleura & left bronchus (Hyrtl).

Internal Circular – Form rather oblique rings towards middle of œsophagus, but horizontal rings above & below; these rings are continuous inferiorly with circular & oblique fibres of stomach.

Cellular Coat – Forms a loose connection between muscular & mucous coats.

Mucous Membrane – Thick, pale, covered with a thick layer of squamous epithelium, thrown into longitudinal folds except during passage of food. Presents a few papillæ, and some small compound racemose glands which are especially abundant at lower part.

Vessels & Nerves – Arteries, four or five of good size from thoracic aorta, and twigs from inferior thyroid, phrenic & coronaria ventriculi. – Veins open mainly into vena azygos major. – Lymphatics, into posterior mediastinal glands. – Nerves from pneumogastrics & sympathetic.

THE STOMACH

Is situated in the left hypochondriac, epigastric, & part of right hypochondria regions, and presents

Ant. Surface – Looks upwards & forwards, and is in contact with under surface o liver, diaphragm, and anterior wall of abdomen opposite *pit of stomach*

Post. Surface – Directed downwards & backwards, and covered with peritoneum o lesser sac, by which sac it is separated from pancreas, great vessels of abdomen crura of diaphragm & solar plexus. Rests upon transverse meso-colon

Great or Splenic End, Great Cul-de-sac or Fundus – Lies beneath the si lower left ribs, in contact with the spleen to which it is connected by th gastro-splenic omentum

Lesser or Pyloric End – In contact with anterior wall of abdomen, under surfac of liver, & neck of gall-bladder

Greater Curvature – Lies above transverse colon, and gives attachment to grea omentum

Lesser Curvature – Connected to transverse fissure of liver by lesser or gastro-hepati omentum, and to under surface of diaphragm by gastro-phrenic ligament

Œsophageal or Cardiac Opening – Funnel-shaped, and situated above & behin the pyloric opening

Pyloric Opening – Guarded by pylorus, and is more movable than the œsophageal.

When the stomach is distended its greater curvature is elevated & carrie forwards, while its anterior surface is turned upwards, and its posterior surfac downward

TRUCTURE of the STOMACH.

Its walls are thickest towards pylorus; they present four coats, and vessels & nerves.

SEROUS COAT — Covers whole surface of stomach except points of attachment of gastro-splenic and greater & lesser omenta.

MUSCULAR COAT — Consists of:

Longitudinal Fibres – Superficial. Continuous with those of œsophagus & small intestine. Thinly scattered over the surfaces; most marked along the curvatures, especially the lesser.

Circular Fibres – Deeper. Form a complete & nearly uniform layer over whole of stomach, & a strong circular ring round pylorus.

Oblique Fibres – The deepest. Form two sets, which embrace the right & left aspects of the œsophageal opening, and spread out over anterior & posterior aspects of stomach except near lesser curvature. They are the continuation of the circular fibres of the œsophagus.

CELLULAR COAT — Serves for the division of the blood vessels before they enter the mucous membrane.

MUCOUS MEMBRANE — Thin towards cardia, thick towards pylorus, and covered with columnar non-ciliated epithelium. Thrown in contracted state of stomach into longitudinal plaits or rugæ, which are most marked along greater curvature and towards lesser end, and which disappear on distention. – When examined with a lens it has, especially near pylorus, a honey-combed appearance due to shallow polygonal depressions or alveoli from 1 to 2 hundredths of an inch in diameter, in bottom of which alveoli are the openings of the

Gastric Follicles, – which are of two kinds:

Peptic Glands – Situated near cardia. Are simple tubular glands lined in their upper fourth with columnar epithelium, and filled with nucleated cells & nuclei in their deeper parts.

Mucous Glands – Situated near pylorus. – Terminate in dilated saccular extremities, or are subdivided into from two to six tubular branches; they are lined throughout with columnar epithelium.

Lenticular Glands – Are also found in small numbers, principally near pylorus & along lesser curvature.

VESSELS & NERVES — Arteries. Are the gastric or coronaria ventriculi, pyloric, gastro-epiploicæ dextra & sinistra, and the vasa brevia. They all break up in the cellular or submucous coat, and then send up branches between the glandular tubes; these branches form a deep capillary plexus round the tubes and a superficial one round their orifices. – Veins. Follow the arteries. – Lymphatics. Are superficial & deep, and open into the glands along the two curvatures. – Nerves. Are from the sympathetic and from the right & left pneumogastric nerves, the right pneumogastric supplying the posterior, and the left one, the anterior surface of the organ.

THE SMALL INTESTINE

Is a slightly narrowing convoluted tube about 20 feet long, connected to the spine by the me sentery in the greatest part of its extent

It is divided into:

DUODENUM — Vide below.

SMALL INTESTINE PROPER — Is rather arbitrarily divided, no define limit existing, into

JEJUNUM — The upper two fifths. Wider, thicker, & more vascular, an has its villi & valvulæ conniventes more, and its Payer's patches les numerous & develope

ILEUM — The lower three-fifths. Narrower, thinner, & less vascular, and ha its villi & its valvulæ conniventes less, and its Payer's patches mor numerous & develope

THE DUODENUM

Is the shortest, widest & thickest part of the small intestine, and has no mesentery. I length is from 8 to 10 inches, or about twelve finger breadths. – Into it open by common orifice the common bile & pancreatic ducts, and the villi & valvulæ conr ventes are larger & more numerous immediately below this opening than in a other part of the small intestine. – Its course i

Upwards & to the right to under surface of liver & neck of gall-bladder:
Downwards in front of right kidney;
Transversely to the left to left side of 2nd lumbar vertebra, where it is crosse by superior mesenteric artery, and where mesentery begin

RELATIONS:

First, or Ascending Portion –

Above – Under surface of liver & neck of gall-bladder;
Behind – Right border of lesser omentum, hepatic artery, bile duc portal vei

Second, or Descending Portion –

In Front – Hepatic flexure of colon;
Behind – Right kidney;
On Inner Side – Head of pancreas, ductus communis choledochus, pa creatico-duodenal arteri

Third, or Transverse Portion –

In Front – Descending layer of transverse meso-colon, superior mese teric vesse
Behind – Aorta, inferior vena cava, crura of diaphragm;
Above – Lower border of pancreas, superior mesenteric vessels.

STRUCTURE of the SMALL INTESTINE.

Four coats, and vessels & nerves.

SEROUS COAT — Completely surrounds small intestine proper, except along its posterior or attached border. The duodenum is but incompletely covered: Its first part is situated between the two layers of gastro-hepatic omentum; its second part is covered in front only by peritoneum; its third part lies behind descending layer of transverse meso-colon.

MUSCULAR COAT — Thicker above than below; consists of fibres:

External Longitudinal – Thinly scattered around intestine;
Deep Circular – Form a thick uniform layer.

CELLULAR or SUBMUCOUS COAT — A nidus for the division of the vessels before they enter the mucous coat.

MUCOUS MEMBRANE — Shaggy; thick & vascular above, thin & pale below; covered with columnar non-ciliated epithelium. – Presents for examination:

Valvulæ Conniventes or Valves Kerkringius – Crescentic reduplications of the mucous & submucous coats, which reduplications surround two-thirds or three-quarters or more of circumference of small intestine. – They begin one or two inches beyond pylorus, and are largest & most numerous immediately below opening of common bile & pancreatic ducts, and also very large and numerous as far as middle of jejunum. They diminish from this point, and nearly disappear in lower part of ileum.

Villi – Minute vascular projections of the mucous membrane one-third or one-fourth of a line in length, and largest & most numerous in upper part of small intestine; Usually flattened or conical, sometimes cylindrical or club-shaped. – They consist of a prolongation of the basement membrane & epithelial layer, and contain numerous granular corpuscles & fat globules, and also, towards the surface, a capillary plexus, and towards the centre, one or two lacteals which are surrounded by a thin layer of longitudinal muscular fibres.

Tubular Glands or Crypts of Lieberkuhn – Minute tubular depressions lined with columnar epithelium, found all over small intestine, and even in large intestine & stomach.

Lenticular, or Vesicular Glands – Solitary & agminated.

Solitary – Scattered throughout small intestine, particularly in lower part.

Agminated, or Payer's Glands – Oval patches placed lengthwise on portion of intestine most distant from attachment of mesentery, and largest & most numerous in ileum; these patches are usually from twenty to thirty in number, and from half an inch to four inches in length.

The individual glands are small sacculated bodies* from half a line to a line in diameter, and without any excretory duct; they consist of a wall of connective tissue, & of greyish semifluid contents. – A rich plexus of blood & lymphatic vessels surrounds them, and fine capillary loops dip into their cavity. – Crypts of Lieberkuhn are collected into circles around the glands, and villi are scattered between & sometimes over them.

Brunner's Glands – Small conglomerate glands found only in duodenum & commencement of jejunum.

VESSELS & NERVES — Arteries. Terminal branches of superior mesenteric encircle intestine beneath serous coat, pierce muscular coat, to which they supply two sets of capillaries corresponding in direction to the two layers of fibres, subdivide in mucous coat, and end in a dense capillary network to the valvulæ, villi, & glands. – Veins accompany the arteries. – Lymphatics form a rich plexus in the mucous & submucous coats, a longitudinal stratum between the two layers of muscular fibres & a subperitoneal plexus in the neighbourhood of the mesentery. – Nerves. From superior mesenteric plexus; form richly gangliated plexuses in submucous coat & between the two layers of muscular fibres.

See Appendix, page 305$^{\text{A.}}$

THE LARGE INTESTINE.

About 5 feet long, sacculated. Diminishes in size till just above anus, where it is considera enlarg

Consists of *cæcum, ascending, transverse, & descending colon, sigmoid flexure* & *rectum.*

CÆCUM or CAPUT CÆCUM COLI — The cul-de-sac situated below entrance of sm intestine into the large; is the most dilated part of col

Lies in right iliac fossa, where it is retained by the peritoneum which covers its front sides, and sometimes surrounds it entirely in a distinct fold, the meso-cæcu

Presents:

Appendix Vermiformis – A tubular prolongation from 2 to 6 inches long & of ab the diameter of a goose-quill connected with lower & back part of cæcu usually directed upwards & inwards behind it, and retained by a fold of pe tone

Ilio-Cæcal or Ilio-Colic Valve, or Valve of Bauhin – Situated at entrance small intestine into the large at upper inner & back part of cæcu

Formed by two crescentic folds of the mucous & submucous coats & circular m cular fibres of the gut, which folds are separated by a narrow antero-poster apertu

The upper fold is nearly horizontal, and is the smallest.

The lower fold is oblique, and is the largest.

At their points of coalescence they are continued upon wall of gut into two p minent folds, the *fræ*

Their surface turned towards the small intestine is covered with villi, the ot surface has no villi, and is quite smoo

ASCENDING COLON —

Upwards to under surface of liver on right side of gall-bladder, where it curves to left, forming *hepatic flex*

Bound down against quadratus lumborum & right kidney by peritoneum which covers front & sides, and sometimes encloses it in a distinct fold, the ascending meso-col

TRANSVERSE COLON or ARCH of the COLON —

Curves forwards & to the left between confines of umbilical & epigastric regions left hypochondrium, where it bends downwards, forming *splenic flexure.* Is v movable, being comprised between the two ascending layers of great omentu which layers join again behind it to form transverse meso-col

Its relations are:

Above – Liver, gall-bladder, great curvature of stomach, lower end of spleen;
In Front – Great omentum, anterior wall of abdomen;
Behind – Transverse meso-colon, 3rd portion of duodenum.

DESCENDING COLON —

Downwards in front of left crus of diaphragm, left kidney & quadratus lumborum left iliac fossa, where it ends in sigmoid flexure. Covered by peritoneum in front at sides, sometimes entirely surrounded by a distinct fold, the descending meso-col

SIGMOID FLEXURE —

Commences at crest of ilium, ascends to right or left, descends, and ends in rect opposite left sacro-iliac synchondrosis. Freely movable, being retained by o a loose fold of peritoneum, the sigmoid meso-col

TRUCTURE of the LARGE INTESTINE.

Four coats:

SEROUS — Thrown, especially on transverse colon, into numerous small pouches filled with fat, the *appendices epiploicæ.*

MUSCULAR — Consists of fibres

External Longitudinal – Are most of them grouped, over cæcum & colon, into three longitudinal bands about half an inch wide, though a few spread out in a thin continuous layer over remainder of circumference of gut; – to these bands, as they are shorter than the intervening parts of the tube, is due the sacculation of the large intestine. These bands are situated as follows:

Posterior – Along attached border of intestine;

Anterior – In front; on transverse colon it lies along attached margin of great omentum.

Lateral – On inner surface of ascending & descending colon, on under surface of transverse.

Internal Circular – Are accumulated in large numbers between the sacculi.

CELLULAR — A nidus for the division of the vessels before they enter the mucous coat.

MUCOUS — Pale, destitute of villi & valvulæ conniventes, thrown into crescentic folds in intervals between the sacculi. Presents a few solitary lenticular glands or closed follicles; its tubular glands are larger & more numerous than those of small intestine; its epithelium is columnar.

VESSELS & NERVES — ARTERIES, from superior & inferior mesenteric; are distributed in same way as over small intestine. – VEINS open into corresponding veins, which form part of portal system. – LYMPHATICS form a plexus in the mucous & submucous layers; those of cæcum & of ascending & transverse colon enter into mesenteric glands, those of descending colon & rectum, into lumbar glands. – NERVES from superior & inferior mesenteric plexuses; form same gangliated plexuses as in small gut.

THE RECTUM

Commences opposite left sacro-iliac synchondrosis.
Passes downwards & to the right to middle, or to a little to the right of middle, of th piece of sacr
Curves forwards upon concavity of sacrum & coccyx, regaining middle line if latter been pass
Inclines downwards & backwards to anus.
Is smooth & cylindrical, not sacculated; about 8 inches long. Rather narrower above th sigmoid flexure, but it increases as it descends, and is greatly dilated just ab anus. – Divided into three pa

UPPER PART — From sacro-iliac synchondrosis to middle, or to a little to the righ middle, of third piece of sacrum; about 4 inches lo
Almost completely surrounded by meso-rectum.
Separated by small intestine from bladder, in the male, & from uterus & vagina, in female; and connected inferiorly with latter organs by the folds of peritone which form margins of recto-vesical & recto-vaginal pouches respectiv
Rests upon pyriformis muscle & sacral plexus of left side.
Has to its left side left ureter & branches of left internal iliac artery.

MIDDLE PART — From middle of third piece of sacrum to tip of coccyx; about 3 inc lo
Covered by peritoneum in front & at sides above, in front only towards middle, at all bel
In relation below & in front with:

In the Male – Triangular portion of base of bladder, vesiculæ seminale vasa deferentia, and under surface of prost
In the Female – Middle part of posterior wall of vagina, to which it is clos adher

LOWER PART — From tip of coccyx to anus; about an inch in length.
Invested by the internal & external sphincters & by the levatores ani.
Separated by a triangular space, the perinæum, from membranous portion of urethr bulb, in the male, from vagina, in the fem

STRUCTURE — Presents:

Serous Coat – Covers upper & middle parts of rectum, the former almost comp tely, the latter in front & at sides above, in front only towards middle, at all bel

Muscular Coat – Very thick; consists of fibres:

External Longitudinal – Form a thick uniform layer all round intestine.
Internal Circular – Are most numerous at lower end of rectum, where th form internal sphinc

Cellular Coat – Forms a loose connection between the muscular & mucous coa

Mucous Membrane – Thick, very vascular, freely movable upon muscular co Presen

Longitudinal Folds – Most marked below; due to contraction of sphinc and disappear on distenti
Permanent Transverse Folds, or Folds of Houston – Three principal on semilunar, sometimes half an inch in depth, situated at upper part right side, near middle of rectum on left side, and at front p opposite base of bladd

Vessels & Nerves – Arteries. From superior, middle & inferior hœmorrhoid they form a rich network beneath & within mucous membrane, the mes of which network are mainly longitudinal in lower part of rectum, a connected opposite anus, by large transverse branches (Quain). – Ve Also mainly longitudinal near anus; open partly into internal iliac partly into inferior mesenteric. – Lymphatics. Open into glands in holl of sacrum, or into lumbar glands. – Nerves. From sacral plexus, sacral & inferior hœmorrhoidal nerves, and from inferior mesenteric hypogastric plexus

ERITONEUM – 1st Tablet.

The peritoneum is by far the most extensive & complex serous membrane of the body. To describe it completely it is necessary to trace:

1. – The two sacs separately in the vertical direction & in the middle line;
2. – The two sacs together in the vertical direction;
3. – The greater sac horizontally below the level of the umbilicus;
4. – The two sacs together horizontally above the level of the umbilicus, or through the foramen of Winslow;
5. – The ligaments formed by the peritoneum, and the omenta & mesenteries.

Along the colon & upper part of the rectum the peritoneum is thrown into numerous pendulous processes filled with adipose tissue and termed the appendices epiploicæ.

THE TWO SACS SEPARATELY.

THE GREATER SAC.

Starting from umbilicus the peritoneum passes: –

- Over anterior wall of abdomen & diaphragm;
- Over upper surface of liver, forming *suspensory or falciform ligament & upper layer of coronary ligament;*
- Over under surface of liver to transverse fissure;
- To lesser curvature of stomach & first portion of duodenum, forming *anterior layer of lesser or gastro-hepatic omentum;*
- Over anterior surface of stomach;
- Downwards in front of intestine, forming *anterior layer of great omentum;*
- Upwards to transverse colon, forming *posterior layer of great omentum;*
- Over under surface of transverse colon;
- To spine, forming *inferior layer of transverse meso-colon* & covering under surface of transverse portion of duodenum;

  (In the fœtus, also occasionally in the child, and even, though very rarely in the adult, the layer of peritoneum which continues the posterior layer of the great omentum ascends in front of the transverse colon without adhering to it, or adhering to it but slightly, and then passes backwards to the spine *above the transverse meso-colon.* The transverse meso-colon is then formed by the peritoneum *again passing forwards from the spine to the transverse colon,* surrounding the latter, *and for the second time passing backwards to the spine.* The pouch between the transverse meso-colon & the posterior layer of the great omentum subsequently disappears by degrees, adhesions amounting finally to complete fusion of the two layers into one, being established between the two walls of the pouch before adult age is reached).
- Along superior mesenteric artery, round small intestine and back to spine, forming *mesentery;*
- Downwards in front of spine & Aorta;
- Over upper part of rectum, forming *meso-rectum;*
- Forwards:
  - In Male: – To bladder, forming *posterior false ligaments of bladder & recto-vesical pouch;*
  - In Female: – To vagina & uterus, forming *posterior ligaments of uterus & recto-vaginal pouch;* and then over uterus & from uterus to bladder, forming *anterior ligaments of uterus & utero-vesical pouch;*
- Over bladder and from bladder to anterior wall of abdomen;
- Up to umbilicus, covering urachus & obliterated hypogastric arteries.

THE LESSER SAC, or SAC of the OMENTUM.

Begins at the foramen of Winslow.

Foramen of Winslow – Is a constriction of the peritoneum bounded by:

- In Front – Lesser omentum containing first part of duodenum, hepatic artery, bile duct & portal vein;
- Behind – Right crus of diaphragm & inferior vena cava;
- Above – Lobus Spigelii of liver (or rather lobus caudatus);
- Below – Hepatic artery as it passes forwards from Aorta.

From this point the peritoneum passes: –

- Downwards to lesser curvature of stomach, forming *posterior layer of lesser or gastro-hepatic omentum.*
- Over posterior surface of stomach;
- Downwards in front of intestine and then upwards, forming the *two internal layers of great omentum;*
- Over upper surface of transverse colon;
- To spine, forming *upper layer of transverse meso-colon;*
- Over pancreas;
- To under surface of liver, forming *inferior layer of coronary ligament,* and over posterior part of under surface of liver to foramen of Winslow.

PERITONEUM — 2nd Tablet.

The two Sacs traced together in Vertical Direction.

From transverse fissure of liver: –
- To lesser curvature of stomach, forming *lesser or gastro-hepatic omentum ;*
- Separate to surround stomach;
- Descend in front of intestine, forming the *two anterior layers of great omentum ;*
- Ascend to transverse colon, forming the *two posterior layers of great omentum ;*
- Separate to surround transverse colon;
- Backwards to spine, forming *transverse meso-colon ;*
- Separate:
  - One descends and forms in succession the mesentery, meso-rectum, recto-ves l pouch (or recto-vaginal & utero-vesical pouches), ;.
  - The other ascends in front of pancreas and passes over back part of under sur e of liver to foramen of Wins '.

(In the fœtus, also occasionally in the child, and even, though very ra: ', in the adult, the two posterior layers of the great omentum ascend in fro: of the transverse colon without adhering to it, or adhering to it but slightly, d then pass backwards together to the spine *above the transverse meso-colon.* . e they separate: – One layer descends, and forms in succession *the tran: se meso-colon*, the mesentery, meso-rectum, &c.; the other layer ascends, as a e stated, over the pancreas & liver. The pouch between the transverse n). colon & the great omentum subsequently disappears by degrees, adhe: is amounting finally to complete fusion of the two layers into one, being e). lished between the two walls of the pouch before adult age is reached.

Greater Sac traced Horizontally below Level of Umbilicus.

From median line of anterior wall of abdomen: –
- To right iliac fossa, where it forms *meso-cæcum* & lower part of *ascending meso-colon ;*
- Along lateral & posterior walls of abdomen to spine, where it meets superior mesen o vessels and forms mesen ';
- To left iliac fossa, where it forms *sigmoid meso-colon ;*
- Along lateral & anterior walls of abdomen to median line.

The two sacs traced together Horizontally above Level of Umbili is or through Foramen of Winsl '.

From median line of anterior wall of abdomen: –
- Over anterior & lateral walls of abdomen & over right kidney;
- Through foramen of Winslow;
- Over front of pancreas;
- To spleen & then to back of stomach, forming *posterior layer of gastro-splenic omentum*
- Over posterior surface of stomach;
- Back to foramen of Winslow, forming *posterior layer of lesser or gastro-hepatic omentum*
- Reflected outwards in front of bile duct, hepatic artery & portal vein, forming *an or layer of lesser or gastro-hepatic omen ;*
- Over front of stomach;
- Round spleen & to under surface of diphragm, forming *anterior layer of gastro-s ic omentum & suspensory ligament of s ;*
- Over left kidney;
- Over lateral & anterior walls of abdomen to median line.

ERITONEUM — 3rd Tablet.

LIGAMENTS — Reflexions of peritoneum from walls of the abdomen or pelvis to viscera which are not portions of the intestinal canal.

Belong to liver, bladder, uterus, & spleen.

Ligaments of the Liver – Four:

Suspensory or Falciform Ligament – Triangular or sickle-shaped fold reflected over obliterated umbilical vein or round ligament, and attached to upper surface of liver, diaphragm, & sheath of rectus.

Coronary Ligament – Consists of two layers separated by a considerable interspace, in which interspace the posterior border of the liver is connected to the diaphragm by firm areolar tissue. Its superior layer & the right half of its inferior layer are formed by greater bag; the left half of its inferior layer is formed by lesser bag.

Lateral Ligaments – The two triangular & pointed extremities of coronary ligament. The left one is the longest & most distinct.

Ligaments of the Bladder – Five in number, and termed false ligaments:

Post. False Ligaments – The margins of recto-vesical pouch, in the male, of utero-vesical pouch, in the female. Contain obliterated hypogastric arteries & ureters.

Lateral False Ligaments – From sides of bladder to sides of pelvis.

Sup. False Ligament – Over urachus and obliterated hypogastric arteries to umbilicus.

Ligaments of the Uterus – Six:

Broad Ligaments – From sides of uterus to sides of pelvis. Their free margin contains from before backwards round ligament, Fallopian tube, & ovary.

Ant. & Post. Ligaments – The margins of utero-vesical & recto-vaginal pouches. Obliterated hypogastric arteries & ureters are contained in both these folds.

Suspensory Ligament of the Spleen – Connects upper end of spleen to diaphragm.

OMENTA — Folds proceeding from one viscus to another. Three:

Lesser or Gastro-hepatic Omentum – From transverse fissure of liver to lesser curvature of stomach. – Its right free border contains hepatic artery, bile duct & portal vein, and forms anterior boundary of foramen of Winslow.

Great or Gastro-colic Omentum – Consists of four layers, of which the most anterior & the most posterior belong to greater bag, and the two internal to lesser bag. The two anterior layers descend from great curvature of stomach & spleen; the two posterior ascend to transverse colon (at least in adult; for arrangement in fœtus see foregoing Tablets).

Gastro-splenic Omentum – Connects hilum of spleen to great cul de sac of stomach. Contains splenic vessels & vasa brevia, and is continuous inferiorly with great omentum.

MESENTERIES — Folds connecting greater part of intestine to posterior wall of abdomen. Seven:

Mesentery Proper – Its root extends from left side of 2nd lumbar vertebra to right sacro-iliac synchondrosis. Its free border contains the small intestine. It is continuous superiorly with inferior layer of transverse meso-colon, inferiorly with meso-cæcum & ascending meso-colon.

Meso-cæcum – Usually peritoneum merely passes in front of cæcum; and also merely in front of ascending colon, forming the

Ascending Meso-colon.

Transverse Meso-colon – Formed by junction behind transverse colon of the two ascending layers of the great omentum. Backwards from transverse colon to spine, where it meets transverse portion of duodenum, and becomes continuous with mesentery.

Descending Meso-colon – Similar to ascending meso-colon.

Sigmoid Meso-colon – Broad & well marked fold, which allows of considerable mobility on the part of sigmoid flexure.

Meso-rectum – Surrounds almost completely first portion of rectum, and covers second portion in front & at sides above, in front only towards middle, not at all below.

THE LIVER.

The largest gland in the body, of a dull reddish brown colour, situated in right hypochondriac epigastric & part of left hypochondriac regions. – Its transverse & antero-posterior diameters, and its greatest thickness are usually about twelve, six, & three inches respectively It weighs from three to four pounds. – Presents :

UPPER SURFACE — Smooth, convex, divided into right, largest, & most convex lobe and left lobe, smaller & flatter, by suspensory or falciform ligament. In relatio with under surface of diaphragm, & the six or seven lower ribs, and to a slight exten in the upright posture & during deep inspirations, especially in women & children with anterior wall of abdomen.

UNDER SURFACE — Vide next Tablet.

ANTERIOR BORDER — Thin, inclined downwards & to the right, notched deepl opposite round & falciform ligaments, and usually more slightly so opposite fundu of gall-bladder. In recumbent posture & during expiration it usually correspond to lower border of ribs & costal cartilages, in upright posture & during deep inspirations, especially in women & children, it descends a little lower.

POSTERIOR BORDER — Thick & rounded, especially to the right, in relation wit pillars & under surface of diaphragm, to which it is connected by coronary ligament and with aorta & inferior vena cava, for passage of which latter vessel it is deepl grooved & sometimes channelled.

RIGHT EXTREMITY — Thick & rounded, attached to diaphragm by right later ligament; descends lower than the left.

LEFT EXTREMITY — Thin & flattened, attached to diaphragm by left lateral ligament; ascends higher than the right.

LIGAMEMTS OF THE LIVER — Five in number:

Round Ligament – The obliterated remains of umbilical vein & ductus venosu Ascends in free margin of falciform ligament from umbilicus to longitudina fissure on under surface of liver, where it joins inferior vena cava.

Falciform or Suspensory Ligament
Coronary Ligament . . . .
Lateral or Triangular Ligaments .
} Formed by peritoneum. – Vide Peritoneu

UNDER SURFACE of the LIVER.

Concave uneven, looks downwards & backwards, and covers stomach, duodenum, hepatic flexure of colon, right kidney & right suprarenal capsule.
Presents four fissures, one of which is divided into two, and two primary lobes, of which the right one, or right lobe proper, presents three sub-lobes or lobules.

FISSURES — Are the:

Longitudinal Fissure – Separates right & left lobes, and extends from deep notch on anterior border as far backwards as posterior border. It is divided into:

Umbilical Fissure – Its anterior & deepest two-thirds, situated in front of transverse fissure; contains umbilical vein in the fœtus, and its obliterated remains in the adult. Is often bridged over posteriorly by a band of liver substance, the pons hepaticus.

Fissure for the Ductus Venosus – Its posterior & shallowest third; contains the ductus venosus in the fœtus, & its obliterated remains in the adult.

Transverse Fissure – Extends transversely to the right from longitudinal fissure for about two inches, lying nearer to posterior than to anterior border. – It transmits hepatic artery, bile duct, portal vein, lymphatics & nerves, the hepatic artery lying to the left & in front, the bile duct to the right & in front, and the portal vein behind.

Fissure or Fossa of the Gall-Bladder – Shallow, broadest in front, nearly parallel to longitudinal fissure on right side of which it is situated, and extends from anterior border to near right extremity of transverse fissure.

Fissure for the Inf. Vena Cava – Extends from behind lobus caudatus to posterior border of liver, where it joins with fissure for ductus venosus. Is often transformed into a complete foramen, by a prolongation of the lobus Spigelii. It gives exit to the hepatic veins which here open into the inferior cava.

LOBES — Are the:

Right Lobe – The largest. Presents the three last named fissures, and also, further to the right, the *impressio colica* for hepatic flexure of colon, behind which is the *impressio renalis* for right kidney & right suprarenal capsule. – It also presents the three following sub-lobes:

Lobus Quadratus – Situated in front of transverse fissure, between fissure for the gall-bladder & umbilical fissure; quadrilateral & broadest from before backwards.

Lobus Spigelii – Situated behind transverse fissure, between fissure for ductus venosus, & fissure for inferior vena cava; more prominent than former, but less regular in shape. Projects into lesser sac of peritoneum.

Lobus Caudatus – A prominent ridge extending from front part of lobus Spigelii to under surface of right lobe proper; forms anterior boundary of fissure for inferior vena cava & upper boundary of foramen of Winslow.

Left Lobe – Is smaller than the right. Its under surface rests upon the stomach, and sometimes extends as far as upper border of spleen.

STRUCTURE of the LIVER*

Presents for examination:

Serous Coat – Covers the whole of the surface of the liver *except the points of attachment of the ligaments & the bottom of the fissures.* It adheres firmly to the fibrous coat.

Fibrous Coat – Covers the whole of the liver, but is of difficult demonstration except at the points of attachment of the ligaments & at the bottom of the fissures. It is *continuous at the transverse fissure with the capsule of Glisson,* and, on the surface of the organ, with the delicate areolar tissue separating the lobules.

Lobules – Small granular bodies from 1-10th to 1-20th of an inch in diameter, more or less rounded or polygonal, imperfectly isolated from each other in man by thin strata of cellular tissue & by small vessels. They are *clustered around the sublobular branches of the hepatic veins, to one of which branches each lobule is appended by its intralobular vein.*

The Hepatic Cells, which form the lobules vary from I-1000*th* to 1-2000*th of an inch* in diameter; they are rounded or polygonal, and contain a *nucleus* with a highly refracting *nucleolus,* yellow particles of *colouring matter, granules of glycogen & oil globules.* They *adhere to each other in rows circularly disposed round the intralobular vein.*

Portal Vein – Its branches are at first *contained in the portal canals,* where they lie with the branches of the hepatic artery, bile ducts, deep lymphatics & nerves in the loose cellular tissue, which forms the capsule of Glisson. Rather large branches, the *vaginal branches* (Kiernan) are given off by the portal vein within the portal canals. From these vaginal branches, and from the *vaginal plexus* which they form, as well as directly from some of the larger branches of the portal vein, smaller *interlobular branches* are given off. These pass out between the lobules, giving off still smaller branches, the *lobular branches,* which latter penetrate into every lobule of the gland, and form a capillary plexus within its periphery.

Hepatic Veins – Their radicles *communicate* within the lobules *with* the *lobular branches of the portal vein.* They converge towards the centre of the lobule, where they *form* a central vein, the *intralobular vein.* This intralobular vein issues from the base of the lobule forming the *sublobular vein,* to which the lobule, as aforesaid, is, so to speak, appended. The sublobular veins join to form the larger hepatic veins.

Bile Ducts – *Arise within the lobules* in a plexiform network surrounding the hepatic cells (Kiernan). To this *intralobular plexus* succeeds an *interlobular plexus,* the larger branches of which coalesce and form *vaginal branches,* which lie in the portal canals with the other vessels & nerves. These vaginal branches coalesce in their turn, and give rise to two large trunks which join in the transverse fissure to form the hepatic duct. – The walls of the *larger bile ducts* present *numerous lateral saccular dilatations* formerly described as mucous glands, but now generally regarded as minute reservoirs or gall-bladders, in which the stored-up bile undergoes perhaps some further elaboration. The *epithelium* of these larger ducts is *columnar;* that of the smaller ducts is *squamous;* that of the smallest, *spheroidal.* – A few *aberrant bile-ducts* not surrounded by liver tissue are found in the left lateral ligament of the liver and in the fibrous bands which sometimes replace the pons hepaticus & the prolongation of the lobus Spigelii behind the inferior vena cava.

Hepatic Artery – Accompanies the other vessels through the portal canals, and gives off corresponding *vaginal & interlobular branches.* These latter give off but *few direct branches to the lobules,* and are *mainly distributed to* the *cellular tissue,* the *walls of the vessels* & the *investing membranes* of the liver. They terminate however in a *capillary plexus* which *communicates* with the *terminal branches* of the *vena portæ* (Kiernan); the blood of the hepatic artery is thus *distributed indirectly to* the *glandular tissue.*

Lymphatics – Are superficial & deep. The deep lymphatics accompany the other vessels in the portal canals, enter the glands situated along the lesser curvature of the stomach, and end in the thoracic duct. Some of the superficial lymphatics take the same course, but most of them join the anterior mediastinal glands and end in the right lymphatic duct.

Nerves – Are derived from the *solar plexus* & from the *left pneumogastric & right phrenic.* They form the hepatic plexus, the branches of which accompany, most of them the hepatic artery, some the portal vein.

*See also Appendix, page 314A.

THE EXTERNAL BILE DUCTS.

Hepatic Duct – Formed in transverse fissure by junction of the two large excretory ducts from right & left lobes.

Downwards & to the right between the two layers of lesser or gastro-hepatic omentum & behind first portion of duodenum, having hepatic artery on the left & vena portæ behind, and joins with cystic duct to form ductus communis choledochus. Is about an inch & a half long, and is intermediate in size between cystic duct & ductus communis choledochus.

GALL-BLADDER — Pear-shaped, three or four inches long, an inch wide at largest part; holds from 8 to 12 drachms. Obliquely directed downwards, forwards, & to the right, & lies in a fissure or fossa on under surface of liver between lobus quadratus & right lobe proper. Presents:

Under Surface – Covered by peritoneum, which in most cases merely passes over it; in relation with hepatic flexure of colon & first part of duodenum; sometimes with pyloric end of stomach. – Occasionally the peritoneum entirely surrounds the gall-bladder, which latter is then connected to the liver by a small mesentery.

Upper Surface – Connected to the liver by firm areolar tissue & vessels; sometimes by a small mesentery.

Anterior Enlarged Extremity, or Fundus – Covered by peritoneum; touches abdominal parietes opposite tip of 10th costal cartilage.

Posterior Constricted Extremity, or Neck – Forms two turns upon itself like an italic *f*, and is continued into the cystic duct.

Cystic Duct – Downwards & to the left between the two layers & along the right border of lesser or gastro-hepatic omentum and behind ascending portion of duodenum, having the cystic artery on the left & the vena portæ behind, and joins with hepatic duct to form ductus communis choledochus. Is about an inch long, and is rather narrower than the hepatic duct.

Ductus Communis Choledochus – Downwards & slightly to the left between the two layers & along the right border of lesser or gastro-hepatic omentum, having hepatic artery on the left & vena portæ behind.

Between head of pancreas & descending portion of duodenum on right side of pancreatic duct, and with pancreatico-duodenal arteries which lie slightly in front.

Perforates muscular coat of intestine in common with the latter duct. Both ducts then run together for about three-quarters of an inch between coats of intestine, and, becoming slightly constricted, open by a common & prominent orifice situated on inner wall of descending portion of duodenum a little below its middle, about three or four inches from pylorus. – The common bile duct is about three inches long.

STRUCTURE

— The external bile ducts, as well as the larger intra-hepatic bile ducts, present fibro-muscular & mucous coats, in addition to a

Peritoneal Investment – Covering under surface & fundus of gall-bladder.

Fibro-Muscular Coat – Consists of a dense meshwork of brilliant fibres of white fibrous tissue interlacing in all directions, and of plain muscular fibres, which latter are mainly longitudinal.

Mucous Coat – Strongly tinged with bile, covered with columnar epithelium and raised in the gall-bladder into a network of prominent rugæ, in the polygonal depressions bounded by which rugæ are seen the openings of numerous mucous follicles. Where the neck of the gall-bladder curves upon itself the mucous membrane projects inwards in the shape of a prominent valvular fold. In the cystic duct it is elevated into a series of oblique crescentic folds, which, together, present somewhat of the appearance of a continuous spiral valve. – The arteries & nerves of the gall-bladder are from the cystic branch of the hepatic artery, & the cæliac plexus; its veins open into the vena portæ.

THE PANCREAS

Lies behind stomach & lesser bag of peritoneum opposite first lumbar vertebra. It is long, narrow, flattened from before backwards, & of a reddish cream-colour, and presents:

Head, or Right Enlarged Extremity – Curves downwards, and is embraced by concavity of duodenum, the ductus communis choledochus & the pancreatico-duodenal arteries lying between the two organs, the former behind, the latter in front. – The lower & back part of the head (sometimes detached from the remainder of the gland, and then called the *lesser pancreas)*, passes to the left behind superior mesenteric vessels, forming the posterior wall of an incomplete canal in which these vessels are enclosed.

Body, or Central Flattened Portion – Presents:

Anterior Surface – Convex, covered by peritoneum belonging to lesser bag, & by posterior surface of stomach.

Posterior Surface – Concave; in relation with:

Pillars of diaphragm, left quadratus lumborum, left kidney & left suprarenal capsule;

Aorta, vena cava, mesenteric vessels, commencement of vena portæ, & left renal vessels.

Upper Border – Thick, corresponds to cœliac axis, and is deeply grooved for splenic artery & vein.

Lower Border – Thinner, separated from transverse portion of duodenum by superior mesenteric vessels.

Lesser End, or Tail – Lies a little higher than the head, in contact with left kidney & left suprarenal capsule, & lower & back part of spleen, to which latter organ it is slightly adherent.

PANCREATIC DUCT, or CANAL OF WIRSUNG — Runs from left to right through whole length of the gland, lying in the vicinity of its anterior surface & lower border. In the head it curves downwards on left side of ductus communis choledochus. Both ducts then perforate together the muscular coat of the intestine, run side by side for about three-quarters of an inch beneath mucous membrane, and open by a common orifice situated on inner wall of descending portion of duodenum a little below its middle, about three or four inches from pylorus. The duct from the lesser pancreas opens into canal of Wirsung near its termination, or, sometimes, forms a supplementary canal which opens separately into duodenum an inch or more above canal of Wirsung.

STRUCTURE — The pancreas is a racemose or conglomerate gland and is very similar to the salivary glands, excepting that its tissue is somewhat softer & looser.

Vessels & Nerves – *Arteries* from the splenic and superior & inferior pancreatico-duodenal. – *Veins* open into the splenic & mesenteric. – *Lymphatics* open into the lumbar glands. – *Nerves* are from solar plexus.

THE SPLEEN

Is compressed & oval in form, soft, brittle, & of a dark reddish-blue colour, and lies in left hypochondrium, embracing cardiac end of stomach, to which it is connected by gastro-splenic omentum. It presents:

Outer Surface – Convex, in relation with under surface of diaphragm; corresponds to 9th, 10th, & 11th ribs.

Inner Surface – Concave. Presents a little behind its middle the hilum, a vertical fissure pierced by several irregular foramina for the blood-vessels, lymphatics & nerves, and is related with:

In Front – Great cul-de-sac of stomach;

Behind – Left crus of diaphragm, left suprarenal capsule & usually a process of lesser sac of peritoneum;

Below – Tail of pancreas.

Upper Extremity – Thick, rounded, attached to diaphragm by suspensory ligament.

Lower Extremity – Pointed, in relation with splenic flexure of colon.

Anterior Border – Thin, frequently notched.

Posterior Border – Thick, rounded, lies on left kidney.

STRUCTURE — The spleen is one of the vascular or ductless glands, and presents:

Serous Coat – Closely adherent. Covers whole of organ except points of attachment of suspensory ligament & gastro-splenic omentum.

Fibro-elastic Coat – Formed of white & yellow elastic fibrous tissues, and contains numerous unstriped muscular fibres in some of the mammalia, but none, it is believed, in man. – It is reflected inwards at the hilum upon the vessels in the shape of sheaths; and both from its inner surface and from these sheaths trabeculæ are given off, which bound lacunar spaces or areolæ all communicating with each other.

Proper Substance – Soft, reddish-brown, pulpy mass, contained in the areolæ. Presents:

Malpighian Corpuscles – Large ovoid cells* from 1-25th to 1-60th of an inch in diameter, attached in groups of six or eight to the small arterial twigs, sessile & usually placed, in mammalia generally, in the angle of division between two arteries, pedunculated & usually pierced by an artery in man. Consist of an indistinctly fibrous capsule partly derived from sheath of supporting artery, on which capsule numerous arterial & venous capillaries ramify, and of semi-opaque granular contents traversed by capillaries, in which contents a few nucleated cells & free nuclei are found. These corpuscles are largest & most numerous in early life; they diminish in size & number when the nutrition fails either through ill health or old age.

Coloured Elements – Are red blood-corpuscles free or sometimes, though rarely in man, included in cells, unchanged or altered in form & colour, also pigment granules, and reddish or black corpuscles or crystals closely allied in composition to hæmatin.

Colourless Elements – Consist of finely granular albuminous matter, nucleated & non-nucleated cells and free nuclei; all these undergo a marked increase towards close of digestive period, and are most abundant in healthy & well fed animals, in which they form one-half or more of the mass of the pulp.

Splenic Artery – Very large & tortuous. Divides in the hilum into five or six branches which supply each of them one particular segment of the spleen, anastomosing but very little with each other. The smaller branches subdivide into tufts or pencils of capillaries, which lie in direct contact with the pulp, some of which capillaries are continued into the veins, while the others open into the lacunar spaces (Gray, Müller).

Splenic Vein – Its radicles arise partly in the capillary network, and partly in the lacunar spaces, which are therefore intermediate between the arteries and the veins (Gray, Müller).

Lymphatics – Few in number in man. Are superficial & deep; pass through glands at hilum to thoracic duct.

Nerves – Are branches of the solar plexus, and are derived partly from semilunar ganglia & partly from right pneumogastric.

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* See Appendix, page 317A.

THE REGIONS of the ABDOMEN

Are *nine in number*, and are demarcated by two horizontal lines joining the *antero-superior spin of the ilium & the cartilages of the ninth ribs*, and by two vertical lines passing, on eith side, from the *eighth costal cartilage to the middle of Poupart's ligament*.

From above downwards these regions are:

In the middle line — Epigastric, Umbilical, Hypogastric; –
On either side — Hypochondriac, Lumbar, Iliac.

THEIR CONTENTS — Are as follows: –

Epigastric R.

Middle part of stomach & pylorus;
Left lobe of liver;
Aorta, inf. vena cava, vena azygos major, thoracic duct; cœliac axis
Semilunar ganglia.

Right Hypochondriac R.

Ascending part of duodenum;
Hepatic flexure of colon;
Right lobe of liver & gall-bladder;
Upper half of right kidney, & right supra-renal capsule.

Left Hypochondriac R.

Cardiac end of the stomach, & spleen;
Splenic flexure of colon;
Tail of pancreas;
Upper half of left kidney & left supra-renal capsule.

Umbilical R.

Transverse colon & great omentum;
Transverse portion of duodenum, & body of pancreas;
Convolutions of small intestine;
Aorta.

Right Lumbar R.

Descending portion of duodenum, & head of pancreas;
Ascending colon;
Lower half of right kidney;
Convolutions of small intestine.

Left Lumbar R.

Descending colon;
Lower half of left kidney;
Convolutions of small intestine.

Hypogastric R.

Upper part of bladder in children, and also in adults when the organ
Uterus in pregnancy; [distende
Convolutions of small intestine.

Right Iliac R.

Cæcum, ureter, spermatic vessels;
Convolutions of small intestine.

Left Iliac R.

Sigmoid flexure of colon, ureter, spermatic vessels;
Convolutions of small intestine.

THE RESPIRATORY ORGANS.

THE LARYNX—1st Tablet.

INTERIOR of the LARYNX.

Is divided in two by the glottis or rima glottidis.

GLOTTIS or RIMA GLOTTIDIS — Antero-posterior opening comprised between the inferior or true vocal cords in its anterior three-fourths, and betwee the arytænoid cartilages in its posterior fourth.

In tranquil breathing it is triangular with base backwards. It is lozenge shaped when fully dilated, as in violent inspirations. It is reduced to a narro slit when sound is emitted; the vocal cords then lying parallel to each othe and their degree of approximation & tension increasing with the height of th sound produced.

In the adult male it is nearly an inch long, and may be dilated to nearl half an inch. In the female, and in the male before puberty, its dimensions ar about one-third les

Inferior or True Vocal Cords - Extend from near middle of receding angl of thyroid cartilage below the false vocal cords to anterior or intern angle of the base of the arytænoid cartilages. They consist of a stron band of yellow elastic fibrous tissue, the *inferior thyro-arytænoid ligamen* which band is continuous inferiorly with the lateral portion of the cric thyroid membrane, is covered internally by a very thin & adherent laye of mucous membrane, and is strengthened externally by the thyr arytænoid muscl

PART ABOVE the GLOTTIS — Is broad & triangular, & presents for exam nation:

Superior Aperture of the Larynx - Triangular, obliquely inclined downwar & backwards, and bounded in front by the epiglottis, & laterally by t arytæno-epiglottidean fold

Superior or False Vocal Cords - Extend from near middle of receding angle thyroid cartilage above the true vocal cords to the anterior surface of t arytænoid cartilages; they consist of a fold of mucous membrane co taining a thin band of yellow elastic fibrous tissue, the *superior thyr arytænoid ligament*, from which a delicate expansion extends over t sacculus laryngis. They bound superiorly the openings of t

Ventricle of the Larynx - Deep oblong saccular depression comprised betwee the superior & inferior vocal cords, and corresponding externally to t thyro-arytænoid muscle. It is continued superiorly & in front by a na row opening into t

SACCULUS LARYNGIS OR LARYNGEAL POUCH - A prolongation of the foregoin which passes upwards & forwards between the superior vocal cord the thyroid cartilage, and is covered externally by the thyr epiglottideus & by the thin upper fasciculus of the thyro-arytænoi and internally by the arytæno-epiglottideus inferior or compress sacculi laryngis. The mucous lining of the pouch is supported by expansion from the superior vocal cord, and presents the openings from 60 to 70 mucous glands, whose secretion lubricates the inferi vocal cord

PART BELOW the GLOTTIS — Is flattened from side to side above, circul below, continuous inferiorly with canal of trache

HE LARYNX—2nd Tablet.

MUCOUS MEMBRANE

Is stretched, on entering the larynx, between the arytænoid cartilages & the epiglottis, forming the *arytæno-epiglottidean folds*. These contain the thyro- & the arytæno-epiglottidean muscles, the cornicula laryngis & the cartilages of Wrisberg, and a large amount of loose cellular tissue, the occasional infiltration of which tissue constitutes the so-called œdema of the glottis.

It is thin, and of a pale rosy colour. It is particularly thin & adherent over the epiglottis, and still more so over the true vocal cords, where it is transparent enough for the ligamentous fibres to be seen through its substance.

Its epithelium is columnar ciliated below the superior vocal cords, and also, in front, as high as the middle of the epiglottis; above these points it loses its cilia, and gradually assumes the squamous form. It is squamous over the true vocal cords.

It is highly sensitive in the upper part of the larynx.

MUCOUS GLANDS — Simple tubular, and conglomerate; particularly abundant over the posterior surface of the epiglottis, in which situation they are received into numerous small pits in the substance of the cartilage; but they are found everywhere beneath the mucous membrane, excepting over the true vocal cords. The glands of the sacculus laryngis, from 60 to 70 in number, pour out their secretion upon the inferior or true vocal cords which it is destined to lubricate. The so-called *arytænoid glands* are collected into a somewhat large mass in the arytæno-epiglottidean folds, in front of the arytænoid cartilages.

VESSELS & NERVES — Arteries. Are the laryngeal branches of the superior & inferior thyroid. – Veins. Open into the superior, middle & inferior thyroid. – Lymphatics. Terminate in the deep cervical glands. – Nerves. Are the superior and the inferior or recurrent laryngeal branches of the pneumogastric, and filaments from the sympathetic. The superior laryngeal nerve supplies the mucous membrane, the crico-thyroid muscle, & in part the arytænoid; the inferior or recurrent laryngeal nerve supplies in part the arytænoid, and all the other muscles, excepting the crico-thyroid.

THE LARYNX — 3rd Tablet.

MUSCLES of the GLOTTIS — Are four on each side, and one in the middle line.

Crico-Thyroideus – Front & sides of cricoid cartilage.
Lower border & inferior cornu of thyroid cartilage. – S. by superior lary geal nerve.
Tilts the thyroid cartilage forwards, and thus elongates & tenses the vocal cords.

Thyro-Arytænoideus – Lower part of receding angle of thyroid cartilage, & posteri surface of crico-thyroid membrane.
By two fasciculi into anterior surface of arytænoid cartilage, and in anterior or internal angle of its base. – S. by recurrent laryngeal nerve.
Draws the arytænoid cartilage forwards, and thus shortens and relaxes the voc cords; it also assists in compressing the sacculus laryngis. The former action is th of its lower & stronger fasciculus, which lies parallel with, & on the outer sid of, the inferior or true vocal cord; the latter action is that of its upper & thinn fasciculus, which lies on the outer side of the sacculus laryngis.

Crico-Arytænoideus Lateralis – Side of upper border of cricoid cartilage.
External or posterior angle of base of arytænoid cartilage. – S. by recu rent laryngeal nerve.
Rotates the arytænoid cartilages so as to bring together their anterior or intern angles & the true vocal cords which are attached to them, and thus constricts the glott

Crico-Arytænoideus Posticus – Broad depression on side of posterior surface cricoid cartilage.
External or posterior angle of base of arytænoid cartilage. – S. by recu rent laryngeal nerve.
Rotates the arytænoid cartilages so as to separate their anterior or internal angl & the true vocal cords which are attached to them, and thus dilates the glottis.

Arytænoideus – Posterior surface & outer border of both arytænoid cartilages, pr senting superficial oblique & deep transverse fibres. – S. by both the superior the inferior or recurrent laryngeal nerves.
Brings together the two arytænoid cartilages, and thus constricts the glottis, esp cially in its posterior part. – Sometimes a small fasciculus, the *Kerato-cricoide* (Merkel), extends, below the preceding, from the cricoid cartilage to the inferio cornu of the thyroid cartilage.

MUSCLES of the EPIGLOTTIS — Are three in number.

Thyro-Epiglottideus or Depressor Epiglottidis – Inner surface of the thyroi cartilage externally to origin of thyro-arytænoid.
Margin of epiglottis & arytæno-epiglottidean fold.
Depresses the epiglottis, and assists in compressing the sacculus laryngis.

Arytæno-Epiglottideus Inferior or Compressor Sacculi Laryngis – Ary tænoid cartilage just above false vocal cord.
Margin of epiglottis.
Depresses the epiglottis, and assists in compressing the sacculus laryngis.

Arytæno-Epiglottideus Superior – Apex of arytænoid cartilage.
Arytæno-epiglottidean fold.
Constricts the superior aperture of the larynx during the second act of deglutition. The oblique fibres of the arytænoideus are sometimes considered as belonging t the arytæno-epiglottidei, which muscles would then decussate in the middl line behind the horizontal fibres of the arytænoideus, or arytænoideus proper

THE LARYNX—4th Tablet.

CARTILAGES — Nine; three single, three pairs:—

THYROID — The largest. Consists of two quadrilateral plates or *alæ* joined in front at an acute angle, the highest & most prominent part of which angle is termed the *pomum Adami.* Presents:

Outer Surface – Presents on either side the

Oblique Line – For sterno-thyroid & thyro-hyoid; passes obliquely downwards & forwards from tubercle near root of superior cornu. The surface behind gives attachment to inferior constrictor.

Inner Surface – Covered by mucous membrane externally & above. Presents in middle line the

Receding Angle – To which are attached the true & the false vocal cords, the thyro-arytænoidei & -epiglottidei muscles, and the thyro-epiglottic ligament & apex of the epiglottis.

Upper Border – Deeply notched opposite pomum Adami, rounded & prominent on either side of notch, concave laterally; gives attach. to thyro-hyoid membr.

Lower Border – Shorter, straighter, connected to cricoid cartilage by crico-thyroid membrane & muscle.

Posterior Border – Thick & rounded; gives attachment to stylo- & palato-pharyngei, and is prolonged upwards & downwards respectively into the

Superior Cornu – Long, narrow; points upwards, backwards & inwards, and gives attachment to lateral thyro-hyoid ligament.

Inferior Cornu – Shorter & thicker; points downwards forwards & inwards, and presents internally a small facet for articulation with cricoid cartilage.

CRICOID — Annular in shape, broad behind, narrow in front; thicker & stronger, but smaller than foregoing. Presents:

Outer Surface – Gives attachment in front & at sides to crico-thyroideus & inferior constrictor; and then presents on either side from before backwards:

Tubercle – Surmounted by an articular facet, for articulation with lesser cornua of thyroid cartilage;

Broad Rough Depression – For attachment of crico-arytænoideus posticus;

Median Vertical Ridge – For attachment of longitudinal fibres of œsophagus.

Inner Surface – Smooth, lined with mucous membrane of larynx.

Upper Border – Inclined downwards & forwards. Gives attachment in front & at sides to crico-thyroid membrane & crico-arytænoideus lateralis, and presents at its posterior & highest part, on either side of a slight median notch, two small oval facets for articulation with arytænoid cartilages.

Lower Border – Horizontal; connected to first cartilaginous ring of trachea by fibrous membrane of that canal.

ARYTÆNOID — Two, small, pyramidal. Rest upon posterior & highest part of upper border of cricoid cartilage, and present:

Anterior Surface – Convex, rough; gives attachment to false vocal cord & upper fasciculus of thyro-arytænoideus.

Posterior Surface – Excavated for attach. of arytænoideus.

Internal Surface – The narrowest, flattened, covered with mucous membrane.

Base – Broad. Presents a smooth concave facet for articulation with cricoid cartilage, and three angles, of which angles two are prominent & important, viz.,

Antero-Internal Angle – Long & pointed; gives attachment to true vocal cord & to lower fasciculus of thyro-arytænoideus.

Postero-Ext. Angle – Short & rounded; gives attach. to the crico-arytænoidei lateralis & posticus.

Apex – Pointed, curved backwards & inwards; articulates on either side with the

CORNICULA LARYNGIS or CARTILAGES of SANTORINI — Two small conical nodules of yellow elastic cartilage sometimes joined to apices of arytænoid cartilages, which apices they prolong backwards & inwards.

CUNEIFORM CARTILAGES or CARTILAGES of WRISBERG — Two small rods of yellow elastic cartilage directed upwards & outwards in free border of arytæno-epiglottidean folds a little in front of arytænoid cartilages; their anterior extremity is slightly enlarged.

EPIGLOTTIS — Median lamella of yellow elastic cartilage in the form of a leaf with the stalk below, and the lamina or expanded part above. Presents:

Apex – Long & narrow; attached by thyro-epiglottic ligament to upper part of receding angle of thyroid cartilage.

Base – Broad, rounded, free.

Anterior Surface – Free in its upper part, where it curves forwards towards base of tongue, to which it is connected by the three glosso-epiglottic folds; adherent below, where it is attached by hyo-epiglottic ligament to upper border of hyoid bone.

Posterior Surface – Free, smooth, concave from side to side, convex from above downwards. Covers superior aperture of larynx during second act of deglutition, and is studded with numerous small pits for the reception of mucous glands.

Lateral Margins – Convex, directed backwards; connected to arytænoid cartilages by the arytæno-epiglottidean folds.

THE LARYNX — 5th Tablet.

LIGAMENTS — Are:

EXTRINSIC — Three; connect larynx to hyoid bone. – They are:

Thyro-Hyoid Membrane – Broad fibro-elastic membrane from
Upper border of thyroid cartilage to
Upper border of hyoid bone, being separated from posterior surface of hyoid bone by a little loose cellular tissue in which a bursa is usually found It is thickest towards middle and perforated laterally by superior laryngeal vessels & nerves. Behind it are the epiglottis & the mucous membrane of the base of the tongue, with a considerable amount of adipose tissue & some mucous glands.

Lateral Thyro-Hyoid Ligaments – Rounded fibro-elastic cords from
Superior cornua of thyroid cartilage to
Extremities of greater cornua of hyoid bone. – These ligaments often contain a small cartilaginous nodule, the *cartilago triticea*

INTRINSIC — Connect cartilages of larynx as follows: On the one hand the cricoi to the thyroid & arytænoid, on the other the epiglottis to the thyroid. – They are:

Crico-Thyroid Membrane – Yellow elastic lamina divided into:

Central Portion – Thick, triangular, broadest below; connects
Contiguous margins of cricoid & thyroid.

Lateral Portions – Thinner; extend from
Upper border of cricoid cartilage as far back as crico-thyroid arthrodia to
Lower border of inferior or true vocal cord, uniting firmly with the latter especially in front. – The central portion is concealed by crico-thyroi muscles, except in mesial line, and is crossed by crico-thyroid branche of superior thyroid arteries; the lateral portions are covered by the thyro & lateral crico-arytænoid muscles, and are lined internally by mucou membrane of larynx

Crico-Thyroid Capsules – Thin, strongest behind; enclose the arthrodia articulations between cricoid & inferior cornua of thyroid, and ar lined internally with synovial membrane

Posterior Crico-Arytænoid Ligament – Short but strong band from
Back of cricoid cartilage to
Back of base of arytænoid.

Crico-Arytænoid Capsules – Thin; surround the arthrodial articulation between upper border of cricoid cartilage & bases of the arytænoid and are lined internally with synovial membrane

Thyro-Epiglottic Ligament – Long & slender band connecting
Apex of epiglottis to
Upper part of receding angle of thyroid.

Hyo-Epiglottic Ligament – Somewhat indistinct; extends amidst a con siderable amount of adipose tissue fro
Anterior surface of epiglottis to
Upper border of hyoid bone.

To the foregoing ligaments must be added the superior & inferio thyro-arytænoid described with the vocal cords, and the somewha indistinct fibro-cartilaginous capsules frequently found between th arytænoid cartilages & the cornicula laryngis

THE PLEURA

Surrounds the lung, lines the parietes of the thorax, and forms the lateral boundary of the mediastina.

Tracing it horizontally from the sternum it passes: –

Over costal cartilages, ribs, & intercostal spaces;
Forwards along side of posterior mediastinum;
Outwards over posterior aspect of root of lung;
Round posterior part of inner surface, posterior border, outer surface, anterior border, anterior part of the inner surface of lung, dipping into the fissures between the lobes;
Inwards over anterior aspect of root of lung;
Forwards along side of pericardium to sternum.

Inferiorly it covers the diaphragm, from which a thin triangular fold, the *ligamentum latum pulmonis,* passes up along the side of the pericardium to the inner surface of the lung & to the lower border of its root.

Superiorly it ascends into the neck an inch or an inch & a half above the first rib, and, under cover of the scaleni, comes in contact with the first & second portions of the subclavian artery.

It is thinnest & most adherent over the lung & over the diaphragm. It is thickest & least adherent over the thoracic walls. Its inner surface is covered by a layer of pavement epithelium, and is moistened by a serous fluid.

Its arteries are from the intercostals, internal mammary, phrenic, inferior thyroid, pericardiac, & bronchial. – Its veins correspond to its arteries. – The lymphatics of the visceral layer join with those of the lung; the lymphatics of the parietal layer join with those of the mediastina & the thoracic walls. – Its nerves are derived from the pulmonary plexuses (Kölliker), and from the phrenic & sympathetic nerves (Lushka).

The two pleuræ come in contact behind the middle of the sternum.

THE TRACHEA & BRONCHI.

THE TRACHEA.

From 5th cervical vertebra to 3rd dorsal. Firm, rounded, & supported by cartilaginous rings in front, flattened & membranous behind.

Relations.

In Front –

Isthmus of thyroid gland, inferior thyroid veins, & thyroidea im artery (when the latter exists)

Remains of thymus gland, left innominate vein, arch of aorta with innominate & left common carotid arteries, great or deep cardiac plexus, bifurcation of pulmonary artery

Sterno-hyoid & -thyroid, anastomotic branch between the anterior jugular veins, sternum, fascia, & skin

Behind –

Œsophagus, which deviates to the left towards lower part of neck; right recurrent laryngeal nerve

On Either Side –

Lateral lobe of thyroid gland; common carotid artery, internal jugular vein, pneumogastric & sympathetic nerves; inferior thyroid artery, left recurrent laryngeal nerve (the right nerve lies somewhat behind the trachea)

Innominate & common carotid arteries, pneumogastric & left recurrent laryngeal nerves; – and farther off, but internally to the pleuræ, right innominate vein & right phrenic nerve, on the right side, left subclavian artery & left phrenic nerve, on the left

THE BRONCHI

Commence opposite the 3rd dorsal vertebra a little to the left of the middle line; the internal septum which marks the separation of the two tubes being slightly deviated to the left by the preponderance in diameter of the right bronchus over the left one. Both divide in the root of the lung into a large inferior and a somewhat smaller superior branch, the former of which, on the right side, gives off a small branch to the middle lobe of the right lung.

RIGHT BRONCHUS – About an inch in length, wider, more horizontal than the left one; enters root of lung opposite 4th dorsal vertebra. – It lies behind the superior vena cava & the right auricle; the right pulmonary artery lies at first below it, and then in front of it; the vena azygos major arches over it from behind.

LEFT BRONCHUS — Smaller, more oblique, nearly two inches long; enters root of lung opposite 5th dorsal vertebra. – It passes beneath the arch of the aorta; the left pulmonary artery lies at first above it, and then in front of it; behind it are the descending portion of the arch, the œsophagus & the thoracic duct.

STRUCTURE of the TRACHEA & BRONCHI

Presents for examination: –

Cartilages – 6 to 8, 9 to 12, 16 to 20, respectively, to right & left bronchi and trachea. They form two-thirds of a circle, and are flat externally & convex from above downwards internally. – The first & the last cartilages of the trachea are thicker & broader than the rest; the lower edge of the latter is prolonged downwards towards its middle, and is at the same time curved backwards, so as to divide the lower circumference of the cartilage into two imperfect rings, which rings form the commencement of the bronchi. Occasionally some of the cartilages bifurcate at one of their extremities, others sometimes join with the neighbouring ones.

Fibrous Membrane – Strong, but extensible. Connects the margins of the cartilages, and, dividing into two layers, extends over both of their surfaces; the layer that covers the outer surface of the cartilages being the thickest.

Muscular Fibres – Form a continuous pale reddish layer between the fibrous & mucous membranes in the posterior flattened portion. They are

External Longitudinal – Arise from the ends of the cartilages, and pass upwards & downwards.

Deep Transverse – Connect the extremities of the cartilages.

Elastic Fibres – Lie beneath the mucous membrane, and are longitudinal in direction. They are most abundant in the membranous portion, where they form thick bundles, which bundles give rise to visible elevations of the mucous membrane.

Mucous Membrane – Of a pale rosy colour. Covered with columnar ciliated epithelium resting on a bed of stratified nucleated cells; the action of the cilia tends to drive the secretions upwards.

Glands – Are of three sizes, and are found in three situations: – Large conglomerate glands lie between the meshes & upon the outer surface of the fibrous membrane in the posterior or membranous portion; smaller glands are found between the layers of the fibrous membrane connecting the cartilaginous rings; still smaller glands are everywhere scattered beneath the mucous membrane.

Vessels & Nerves – Arteries. From the inferior thyroid & the bronchial. – Veins. Join the thyroid plexuses & the bronchial veins. – Lymphatics. Open into the mediastinal glands. – Nerves. From the trunk & the recurrent branch of the pneumogastric, & from the sympathetic.

THE LUNGS.

Light, porous, crepitant, elastic.

Of a pinkish white at birth, of a mottled slate colour in the adult; the mottling b coming darker & darker as age advances. Smooth & shining, marked out by dar lines into polygonal spaces corresponding to the bases of the superficial lobule which spaces are variously crossed by other more delicate line

Conical in shape, and present :–

Outer Surface – Convex, deepest behind. Presents on either side a deep fissure obliq downwards & forwards from near apex to base, and, on the right side, anoth fissure oblique upwards & forwards from the middle of the foregoing. By the fissures the left lung is divided into two lobes, the right one into three; the inferi lobe is the largest in both lungs, and the middle lobe of the right side, the smalle of a

Inner Surface – Concave, deeply excavated in front, especially on the left side, to mak room for the heart; presents the hilum a little above & behind its middl

Anterior Border – Thin, oblique, shorter than the posterior, deeply notched inferiorl on the left side so as to expose the pericardium; comes in contact with its fello behind middle of sternum, the pleuræ alone being interpose

Posterior Border – Thick, rounded, vertical, longer than the anterior.

Base – Broad, concave, oblique downwards & backwards; rests upon diaphragm, and i circumference fits into the groove between the diaphragm & the ribs. Descen lower down on the left side than on the righ

Apex – Passes up into root of neck an inch or an inch & a half above first rib, and, und cover of the scaleni, comes into close contact with first & second portions of su clavian arter

The Right Lung is the *shortest* in consequence of the diaphragm ascendin higher on the right side than on the left; the *broadest* owing to the inclinati of the heart to the left; and somewhat the *largest*. – The Left Lung is the *longe* *narrowest*, and somewhat the *smalle*

THE ROOT of the LUNG

Consists of the bronchus, pulmonary & bronchial vessels, lymphatic vesse & glands, and pulmonary plexuses of the pneumogastric & sympatheti which parts are all enclosed in a pleural sheath, and are bound togethe by areolar tissue in the following order

From Before Backwards

On Either Side: –
- *Pulmonary veins* with the *anterior pulmonary plexus ;*
- *Pulmonary artery ;*
- *Bronchus* with the *bronchial vessels, lymphatics vessels & glands, an the posterior pulmonary plexu*

From Below Upwards

On Right Side – *Pulmonary veins, pulmonary artery, bronchus,* with &
On Left Side – *Pulmonary veins, bronchus, pulmonary artery.*

THE ROOT OF THE RIGHT LUNG — Lies behind the superior vena cava & th right auricle; the vena azygos major arches over it fro behind

THE ROOT OF THE LEFT LUNG — Passes beneath the arch of the aorta; behin it are the descending portion of the arch, the œsophagus the thoracic duct. – The root of each lung has also in fro of it the phrenic nerve, and behind it, the pneumogastri

STRUCTURE of the LUNGS

Presents *Serous coat, Sub-serous areolar tissue, & Parenchyma.*

PARENCHYMA of the LUNGS — Presents for examination: –

BRONCHIAL TUBES — They are circular, and they divide & subdivide dichotomously. Sometimes, however, three branches arise together; and single lateral branches are also occasionally met with. Their structure, which is but a modification of that of the trachea & bronchi, remains essentially the same up to the point where, their diameter being reduced to about $\frac{1}{3}$ or $\frac{1}{4}$ of a line, or to from $\frac{1}{30}$ to $\frac{1}{50}$ of an inch (Rainey), they penetrate into the lobules (lobular bronchial tubes), and become continuous with the intercellular passages. They present therefore: –

Cartilages – Thin laminæ of various forms & sizes, irregularly scattered over the whole circumference of the tubes; largest & most distinct in the angles of bifurcation.

Fibrous Membrane,
Muscular Fibres,
Elastic Fibres,
Mucous Membrane,
Glands.

The same as in the trachea & bronchi, except that the muscular & elastic longitudinal fibres and the glands spread out uniformly round the whole circumference. The muscular fibres however, are mainly circular; and these circular fibres form an almost continuous layer.

The bronchial tubes are generally found to lie between & behind the corresponding branches of the pulmonary artery & vein.

LOBULES — Are miniature lungs, pyramidal with base outwards, large ($\frac{1}{2}$ a line to a line) on the surface, smaller & polygonal, in the interior of the lung. They present: –

LOBULAR BRONCHIAL TUBE – The terminal ramification of the bronchial tube, to which the lobule is suspended. Is similar in structure to the larger bronchial tubes. Its diameter is reduced to about $\frac{1}{3}$ or $\frac{1}{4}$ of a line or to from $\frac{1}{30}$ to $\frac{1}{50}$ of an inch (Rainey).

INTERCELLULAR PASSAGES – The ramifications from four to nine in number, of the lobular bronchial tube within the lobule. Their walls are covered with lateral saccular dilatations. Their structure is much more simple than that of the trachea, bronchi, & bronchial tubes: – The

Cartilages, Muscular Fibres & Glands of the latter have disappeared, and there remains of the primitive structural elements of the air-passages at this point of their course but a

Fibro-Elastic Membrane formed of longitudinal bundles of white & yellow elastic fibrous tissues, and a

Mucous Membrane, – the epithelium of which is no longer columnar & ciliated, but is simply squamous, as in the air-cells.

AIR-CELLS – Small alveolar recesses separated from each other by thin septa, and communicating freely with the intercellular passages. – Their diameter varies from $\frac{1}{70}$ to $\frac{1}{200}$ of an inch, and is greatest at the apex & borders, and on the surface of the lung. – In structure they are reduced to the greatest degree of simplicity; their walls are formed of a basement membrane, supported by a few elastic fibres, lined internally with pavement epithelium, and in the substance of which the pulmonary vessels ramify.

PULMONARY VESSELS.

PULMONARY ARTERY – Forms a very dense capillary plexus on the walls of the intercellular passages & air-cells; the interspaces between the capillaries of which plexus are smaller than the capillaries themselves.

PULMONARY VEINS – Arise from the above plexus, and also from some of the terminal ramifications of the bronchial arteries. – The pulmonary vessels are generally found to lie in front of the corresponding bronchial tubes, the artery being above the vein. – The vessels of the different lobules are distinct from each other.

BRONCHIAL VESSELS.

BRONCHIAL ARTERIES – Supply mainly the larger bronchial tubes, the interlobular cellular tissue & the walls of the pulmonary vessels. Some of the terminal ramifications reach the smaller bronchial tubes, and join with the pulmonary veins.

BRONCHIAL VEINS – Open into the vena azygos major on the right side, into the superior intercostal on the left.

LYMPHATICS — Superficial & deep; end in the bronchial glands.

NERVES — From the anterior & posterior pulmonary plexuses of the pneumogastric & sympathetic. Small ganglia are found upon the sympathetic nerves.

INTERLOBULAR CELLULAR TISSUE — Binds all these parts together pretty firmly in the adult; more loosely in the fœtus, for the lobules of the fœtal lung can easily be separated by dissection. – In the adult & the aged it contains a large amount of the peculiar dark colouring matter of the lung, which probably consists of a mixture of animal matter & carbon not included in cells.

THE THYROID GLAND.

Soft, brownish, very vascular, weighs from one or two ounces; is normally a little larger in females than in mal
Lies in front & at sides of upper part of trachea & œsophagus, and of lower part of larynx & pharynx; latera
it also covers the common carotid & inferior thyroid arteries, the internal jugular vein, the pneum
gastric, sympathetic, & recurrent laryngeal nerves. It is covered by the sterno-hyoid & -thyroid, and om
hyoid muscles, and, laterally, by the sterno-mastoid.
It presents two *lateral lobes* & an *isthmus*, and sometimes a *third lobe* or *pyramid;* and with it is sometimes conne
[ted a muscle, the *levator glandulæ thyroid*

Lateral Lobes–Somewhat conical, broad below, narrow above; about two inches long, & thr
quarters of an inch wide, the right lobe being a little longer than the left one; pass upwar
& backwards from opposite fifth or sixth ring of trachea to inferior cornu & adjoining pa
of ala of thyroid cartilage, to which they are connected by loose areolar tissue.

Isthmus – Joins the lateral lobes in their lower third, and usually covers the third & four
rings of the trachea; it varies, however, a good deal as regards position.

Third Lobe, or Pyramid – A conical mass of gland-tissue (sometimes of fibrous tissue onl
which, when it exists, passes up, usually from left lobe, or from left part of upper bord
of isthmus, as far as the hyoid bone, to which it is attached by loose fibrous tissue.

Levator Glandulæ Thyroideæ – Consists of a few muscular fibres usually derived fr
the thyro-hyoid, which, when they exist, pass up to the hyoid bone either from the pyrami
[process or from the isthm

STRUCTURE.

Presents a thin fibrous capsule, surrounding a multitude of closed vesicles grouped togeth
by areolar tissue and more or less flattened by mutual pressure. These vesicles vary in si
from $\frac{1}{850}$ of an inch to the size of a millet seed; they consist of a basement membrane,
yellow glairy contents coagulable by heat & by alcohol, and of a few nucleated cells, whi
in the fœtus & young child, are arranged in a continuous layer on the inner surface of t
basement membrane, but, in the adult, are usually found floating about in the fluid.

Vessels & Nerves – *Arteries*, from sup. & inf. thyroid, and from thyroidea ima
Neubauer, when it exists; remarkable for their large size & numerous anastomoses; te
minate in a capillary plexus around the vesicles. *Veins*, open into sup., middle, & inf. thyroid
Lymphatics, originate in connective tissue between the vesicles & beneath the capsule; fo
numerous large anastomosing trunks, and end in deep lymphatics of neck. *Nerves*, fr
middle & inf. cervical ganglia of the sympathetic; accompany the arteries, and present here
[there a few ganglion-cells; their mode of termination is not know

THE THYMUS GLAND.

Soft, pinkish-gray, lobulated body, lying in upper part of anterior mediastinum & lower part of front of ne
Attains its full size towards end of second year, when it weighs about half an ounce, and measures t
inches in length, one and a half in breadth, and three or four lines in thickness. It subsequently dwindl
away, and has all but disappeared at puberty. Consists of two lateral lobes placed side by side and for
ing together a pyramidal-shaped mass, broad below, narrow above. Sometimes there is a third lobe betwe
[the two others. Presents:

Apex – Frequently reaches up as high as lower border of thyroid gland.

Base – Rests on upper part of pericardium.

Anterior Surface – Convex, covered by upper piece & upper part of middle piece of sternu
& by sterno-hyoid & -thyroid ms.; crossed laterally in thorax by internal mammary vesse

Posterior Surface – Concave, rests upon pericardium, arch of aorta, left innominate vein, & lar
[arteries of root of neck, and, in the neck, upon the trache

STRUCTURE.

The organ is surrounded by a fibrous capsule, and divided by trabeculæ into lobul
primary & secondary. These lobules are now shown to consist of numerous small masses
lymphoid tissue similar in every respect to those which form the lenticular glands of t
intestine, the Malpighian corpuscles of the spleen, etc., *i.e.*, of masses of delicate retifo
tissue, whose meshes are closely packed with lymph-corpuscles, and pervaded with capi
laries. And it may be added that the error long entertained in respect of all such structure
to the effect that they consist of a capsule filled with semifluid contents, is due partly to
slight condensation of the retiform tissue towards the periphery of the lymphoid masses, a
partly to the circumstance that the more delicate internal meshes easily break down a sho
time after death. The appearance of a great central cavity, the so-called "reservoir of t
thymus," ramifying in all the lobes & lobules, is also deceptive. And so also, most like
is the embryonic appearance, described by Mr. Simon, of a primitively linear tube fro
which ramifying diverticula branch out: the tube so described is probably a collection
multiplying cells enclosed within proliferating trabeculæ & a thickening capsule.

Vessels & Nerves: – *Arteries* from the int. mammary, inf. & sup. thyroid, subcla
ian, & carotid; said to penetrate directly, in some animals, into the centre of the lobules, a
there to form a plexus, from which branches would radiate towards the periphery. Th
arrangement would explain the appearance of a vascular membrane lining the so-calle
reservoir & its prolongations. In most animals, however, the arteries ramify mainly, as
the case with the lenticular glands of the intestine, on the surface of the lobules, when
smaller twigs converge towards the centre. *Veins*, open mainly into the left innominat
Lymphatics, originate around, and partly enclose, the masses of lymphoid tissue, formi
an intralobular plexus. This plexus is succeeded by an interlobular plexus, the larg
branches of which open into the anterior mediastinal glands. *Nerves:* little is known abo
them, except that sympathetic fibres run along the arteries which supply the gland.

THE MALE GENITO-URINARY ORGANS.

THE KIDNEY

Is situated in lumbar region behind peritoneum, and extends from 11th rib to near crest ilium, right kidney lying a little lower than left o

Presents:

Ant. Surface – Convex, looking slightly outwards, covered at upper & outer part by peritoneu and in relation wi

On Right Side – Right lobe of liver, descending portion of duodenum, ascending col

On Left Side – Tail of pancreas, lower end of spleen, descending colon.

Post. Surface – Flat; rests upon 11th & 12th ribs, crus of diaphragm, psoas magnus, and anter lamella of aponeurosis of transversalis, which latter separates it from quadra lumboru

Sup. Extremity – Thick, rounded, directed inwards, covered by suprarenal capsule. Corr ponds on left side to upper border, on right side to lower border, of 11th r

Inf. Extremity – Smaller, flattened, directed outwards. Descends to near crest of ilium.

Outer Border – Convex, directed backwards & slightly upwards.

Inner Border – Concave, directed forwards & slightly downwards. Presents the *hilum*, a l gitudinal fissure most marked behind, which leads into the *sinus*, and contains fr before backwards renal vein, renal artery & uret

The kidneys are subject to frequent

VARIATIONS in:

Form & Size – One or both being longer & narrower, or shorter & more ro ded; or one being more or less enlarged & the other proportionat diminish

Situation – One or both being situated lower down than usual, occasiona in the pel

Number – There being but one kidney sometimes of a horse-shoe shape & sit ted in front of the vertebræ, or there being a supernumerary kidn

THE URETER.

The excretory duct of the kidney commences in the

Calices, – small tubes from 7 to 13 in number, which embrace each of them one, t or more papillæ, and join to form t

Infundibula, – larger tubes usually three in number, which join to form the

Pelvis – funnel shaped dilatation of upper part of ureter compressed from bef backwards, and situated at lower & back part of hilu

The ureter passes:

Downwards & inwards upon psoas, beneath peritoneum & spermatic vessels, and, the right side, on right side of inferior vena cav

Over common or external iliac artery, being covered by termination of ileum on t right side, by sigmoid flexure of colon, on the le

Forwards & inwards, –

In the Male – In posterior false ligament of bladder, and on outer side of v deferens & below obliterated hypogastric arte

In the Female – In posterior ligament of uterus and over side of cervix ut & upper part of vagina

to posterior angle of trigonum vesicæ, passing obliquely throu walls of bladder for about $\frac{3}{4}$ of an in

It is from 16 to 18 inches long, and of about the diameter of a crow-quill.

The calices, infundibula, pelvis & ureter are formed of fibrous, muscular & mucous coats. T muscular coat consists, in the greater part of the ureter, of two longitudi layers comprising an intermediate circular one; the epithelium of the muc coat is spheroid

STRUCTURE of the KIDNEY.

Fibrous Capsule – Thin, smooth & firm, but easily torn off

Medullary Substance – Dense, dark, striated, collected into from 8 to 18 *pyramids of Malpighi*, the apices of which terminate in the calices by rounded eminences, the *papillæ*. – Is formed by the straight tubuli uriniferi or tubes of Bellini, and by the looped tubes of Henle.

Cortical Substance – The three-fourths of the gland. Soft, reddish, granular; sends prolongations inwards between the pyramids. – Is formed by the tubuli contorti & the Malpighian corpuscles, and also, near the bases of the pyramids, by the prolongations of the tubes of Bellini termed tubes of Ferrein.

Intertubular Stroma – Most abundant in cortical substance & in young subjects, and much more abundant in the lower animals than in man. Is nearly homogeneous, and contains but a few [nuclei & connective tissue corpuscles.

Vessels & Nerves – Vide below.

TUBULI URINIFERI.

Commence in the *capsules of the Malpighian corpuscles*, and constitute in succession the *tubuli contorti*, *the looped tubes of Henle*, and the *straight tubes of Bellini*, which two latter systems of tubes are joined together here & there by larger convoluted tubes of junction (Schweigger-Seidel), and perhaps also by a system of small anastomosing tubules with occasional blind diverticula (Chrzonszczewsky). – They are all formed of a homogeneous basement membrane lined with a thick layer of spheroidal epithelium.

MALPIGHIAN CORPUSCLES – Small rounded bodies about $\frac{1}{120}$ of an inch in diameter, disposed in double rows between the pyramids of Ferrein, among the convoluted tubes of the cortical substance. Consist of a vascular tuft, plexus or *glomerulus* enclosed in a dilatation always terminal in mammals of a uriniferous tube, and formed by an afferent artery & by an efferent vessel, which latter is not a vein, for it breaks up again into a capillary network round the tubes of the cortical substance. The glomerulus hangs naked in the Malpighian corpuscle (Bowman), or is covered by a thin layer only of epithelium.

CONVOLUTED TUBES OR TUBULI CONTORTI – Form the greater part of the cortical substance, and the whole of its outer portion. They are continuous on the one side with the capsules of the Malpighian corpuscles, and on the other, not, as was believed until lately, with the straight tubes of the medullary substance, but with the looped tubes of Henle. Their diameter is $\frac{1}{600}$ of an inch.

LOOPED TUBES OF HENLE – Have been described of late years only, and it is but very recently that their true connections have been made out. – They are the continuation of the tubuli contorti of the cortical substance. They descend a variable distance in the substance of the pyramids between the straight tubes or tubes of Bellini, and then turn up abruptly & reascend to the bases, or to near the bases of the pyramids. Here they open into the tubes of Bellini, either directly, or through the intervention of larger convoluted tubes of junction (Scheigger-Seidel), and perhaps also of a system of small anastomosing tubules with occasional blind diverticula (Chrzonszczewsky). – Their diameter is but about $\frac{1}{3}$ or $\frac{1}{4}$ of that of the straight tubes, while their walls are rather thicker.

STRAIGHT URINIFEROUS TUBES OR TUBES OF BELLINI — Form the greater part of the pyramids of Malpigi, and also, under the name of tubes of Ferrein, a portion of the central part of the cortical substance. They are not, as was believed up to very recently, the continuation of the tubuli contorti, their only connection with these tubes being through the looped tubes of Henle. – They open on the apices of the pyramids by minute orifices about 1,000 in number, and, if traced from this point, are seen to pass up towards the sides & bases of the pyramids in slightly diverging lines, bifurcating again & again at very acute angles. Greatly increased in number, but diminished in size from $\frac{1}{300}$ of an inch, their diameter at the apices of the pyramids, to $\frac{1}{600}$ of an inch, they then pass, under the name of tubes of Ferrein, into the cortical substance, where they are at first collected into small diverging bundles, the pyramids of Ferrein. Near the bases of the pyramids they are believed to anastomose loopwise with each other, and again to course inwards. The tubes of Henle open into them at different points of their course, either [directly or indirectly, as above explained.

VESSELS & NERVES.

Renal Artery – Divides just before entering the sinus into four or five branches, the subdivisions of which pass up between the pyramids as far as their bases, and then form a series of anastomotic arches between the medullary & the cortical substances. From these arches smaller branches ascend between the double rows of Malpighian corpuscles, giving off to each corpuscle its afferent artery. The efferent vessel leaves the corpuscle in close vicinity to the afferent artery, and again breaks up, in the cortical substance, into capillary meshes, which are rounded among the convoluted tubes and elongated among the tubes of Ferrein; branches to the capsule of the kidney join freely with twigs from the lumbar arteries. The arteries of the medullary portion are derived either from the foregoing capillaries, or from the arches at the base of the pyramids; they pass down between the straight tubes, breaking up into capillaries and joining in anastomotic loops. – Renal Vein. Its radicles have a stellate arrangement on the surface of the organ; they then pass down to the bases of the pyramids, where they form anastomotic arches, and are joined by the veins of the medullary substance. The larger branches descend between the pyramids to the sinus. – Lymphatics. Superficial & deep, most abundant in the cortical substance, where they form freely communicating lymphatic spaces; they open into the lumbar glands. – Nerves. Derived from renal plexus & from lesser splanchnic nerves; contain filaments both from sympathetic & from cerebro-spinal systems. Their precise mode of termination is not known

THE BLADDER

When

Empty, – Is deeply situated behind pubes, in front of rectum, in the male, of uterus & vagina, in female, and is compressed from before backwards & triangular with base downwards
Moderately full, – Is rounded, and partly fills pelvis;
Distended, – Becomes egg-shaped, curves slightly forwards, and rises into abdominal cavity sometimes as high as umbilicus

In Female bladder is normally smaller, though sometimes larger through distention, and is widest from side to side. In Children it is conical, and points up higher into abdomen

Presents:

Ant. Surface – Destitute of peritoneum, and in relation with triangular ligament of urethra, pubes & pubo-prostatic ligaments, and with anterior wall of abdomen in children, and also in adults when bladder is distended

Post. Surface – Covered by peritoneum, and separated by convolutions of small intestine from rectum in the male, and uterus in the female

Lateral Surfaces – Crossed towards their middle by obliterated hypogastric artery, below & behind by ureter, above & behind in male by vas deferens which latter first crosses hypogastric artery externally, and then passes between bladder & ureter. – Covered by peritoneum above & behind hypogastric artery, and rest below & in front on pelvic fascia

Apex – Connected to umbilicus by urachus & by obliterated hypogastric arteries behind which it is covered by peritoneum

Base or Fundus – The enlarged part directed downwards & backwards. – In relation with

In the Male – Second portion of rectum, upon which rests the part bounded by the recto-vesical fold of the peritoneum, the vesiculæ seminales & vasa deferentia, and the prostate gland. – Is covered behind by peritoneum, the recto-vesical fold descending to about four inches from the anus when the bladder is distended, and nearly reaching the prostate when the bladder is empty

In the Female – Anterior wall of vagina & lower part of cervix uteri.

Neck – Directed downwards & forwards, and now known to be the lowest part of the bladder both in the male & female, when in the erect posture; is surrounded in the male by the prostate gland

LIGAMENTS of the BLADDER

Are five true ligaments, and five false ones formed by peritoneum.

TRUE LIGAMENTS — Anterior & Lateral formed by pelvic fascia & Superior or Urachus, a remnant of allantois.

ANT. OR PUBO-PROSTATIC LIGAMENTS — From back of pubes on either side of symphysis to front of neck of bladder & upper surface of prostate. Contain a few muscular fibres passing to bladder, and are separated by a narrow groove containing dorsal vein of penis.

LATERAL LIGAMENTS — Broad & thin; formed by recto-vesical layer of pelvic fascia as it passes from upper surface of levator ani to capsule of prostate & side of bladder.

URACHUS, or SUP. LIGAMENT — Fibro-muscular cord extending from apex of bladder, where it is wide & expanded, to umbilicus, where it is contracted and lost in umbilical cicatrix. Sometimes partly pervious, communicating with bladder, sometimes completely pervious forming umbilical urinary fistula.

FALSE LIGAMENTS — Posterior, Lateral & Superior.

POST. FALSE LIGAMENTS — The margins of the recto-vesical pouch of peritoneum in the male, of the utero-vesical pouch in the female, where they are much smaller. Contain the obliterated hypogastric arteries & ureters.

LATERAL FALSE LIGAMENTS — From sides of pelvis to sides of bladder.

SUP. FALSE LIGAMENT — Over urachus & obliterated hypogastric arteries to umbilicus.

STRUCTURE of the BLADDER.

Four coats, and vessels & nerves: –

Serous Coat – Covers posterior surface & sides, and partly also the base or fundus, the peritoneum descending upon the latter part of the organ to about four inches from the anus when the bladder is distended, and nearly reaching the prostate when the bladder is empty.

Muscular Coat – Consists of: –

External Longitudinal Fibres – Arise from front of neck, from anterior true or pubo-prostatic ligaments, & from sides of prostate; they spread out mainly over anterior & partly over lateral surfaces of bladder, some being continued into urachus, and those of anterior surface also passing over apex and down posterior surface to back of neck, & to prostate or vagina.

Intermediate Circular Fibres – Are thinly scattered over body of bladder, but they form round the neck a thick circular ring, the *sphincter vesicæ*, which is continuous in front with circular fibres of prostatic portion of urethra.

Internal Longitudinal or Submucous Fibres (Ellis) – Form a delicate layer most marked in lower part of bladder, and continued inferiorly upon prostatic portion of urethra.

Two Oblique Bands, the Muscles of the Ureters (Sir C. Bell) – Extend from behind orifice of ureters to back of middle lobe of prostate.

A Strong Transverse Band – Joining the orifices of the ureters (Ellis).

N. – According to Dr. Pettigrew all these muscular fibres will be seen, if traced continuously, to form figure-8 loops, which loops point towards the apex & the base of the bladder, and are so arranged as to present their two extremities on one aspect of the bladder & their point of decussation on the opposite aspect; these loops would form four sets, viz., anterior & posterior well developed, and two lateral less developed.

Cellular Coat – Connects the muscular & mucous coats, and is more intimately joined to the latter than to the former.

Mucous Coat – Soft, of a light rosy colour, often thrown into prominent folds or rugæ (fasciculated bladder) through hypertrophy of the muscular coat, sometimes depressed into saccular pouches (sacculated bladder) through the effects of stricture. Its epithelium is intermediate between the columnar & the squamous. It presents a few mucous follicles, and, near the neck, some small racemose glands, and is loosely connected to the muscular coat, except over the

Trigonum Vesicæ – Triangular smooth area, pale in colour, bounded by the orifices of the urethra & ureters and by the projections of the muscles of the ureters & of the transverse muscular band joining the orifices of the latter. It corresponds to the interval at the base of the bladder bounded by the vesiculæ seminales & vasa deferentia, the recto-vesical fold of the peritoneum, & the prostate gland; and from its apex there projects into the neck of the bladder the

Uvula Vesicæ – A slight elevation formed by the submucous tissue and by the internal longitudinal or submucous muscular fibres (Ellis), and also, in morbid cases, by the hypertrophy of the middle lobe of the prostate.

Vessels & Nerves – *Arteries.* Are the superior, middle & inferior vesical, and twigs from the middle hæmorrhoidal, uterine, vaginal & obturator. – *Veins.* Form a complicated plexus round the neck & sides of the base, and open into the internal iliacs. – *Lymphatics.* Open into the pelvic glands. – *Nerves.* Are from the sacral & hypogastric plexuses, the former supplying principally the base & neck, and the latter, the upper part of the bladder.

THE MALE URETHRA

Is about 8½ inches long, and extends from neck of bladder to end of penis.
It presents beneath the pubes a fixed curve concave superiorly, and in front of the pubes the flaccid state of the penis, a second flexible curve concave inferior
It is divided into: -

PROSTATIC PORTION — The widest & most dilatable part, spindle-shaped, 1¼ inch long; passes through the prostate from base to apex, lying nearer its upper than lower surface. Its transverse section is of a horse-shoe shape concave inferior On its floor are the following parts:

Urethral Crest, Verumontanum or Caput Gallinaginis – Longitudinal elevation 8 o lines in length and 1½ lines high at its central & highest part, consisting, acco ing to Kobelt, of muscular fibres & erectile tissue. On either side of the cr is t

Prostatic Sinus – A longitudinal groove into which open the ducts of the lateral lobe the prostate. On the front part of the crest is t

Utricle, Sinus Pocularis or Vesicula Prostatica – An expanding cul-de-sac, whi passes backwards into the substance of the middle lobe of the prostate for abo a quarter of an inch, and upon or within the margins of which are the slit-li openings of the ejaculatory duc

MEMBRANOUS PORTION —The shortest, and, excepting the meatus, the narrowest pa of the canal. It extends from apex of prostate to bulb of corpus spongiosum, and situated between the two layers of the deep perinæal fascia, which layers are pı longed around it, the one downwards & forwards, the other upwards & backwar Its upper surface is concave superiorly, ¾ of an inch long, and situated about an in below & behind the pubic arch, from which arch it is separated by the anterior fib of the compressor urethræ muscle & by the dorsal vessels & nerves of the penis. under surface is convex inferiorly, only ½ inch long (in consequence of the bulb pı jecting backwards beneath the urethra), and separated from the rectum by a triang lar space, broad below, narrow above, the perinæu

SPONGY PORTION — Commences within the bulb below & behind the symphysis pub ascends a short distance in front of the symphysis within the corpus spongiosu curves downwards with the latter in the flaccid state of the penis, and ends at the meat urinarius. It is about six inches long. In the greatest part of its course it is unifo in size, and intermediate between the prostatic & membranous portions; it is dilate however, within the bulb & within the glans penis (in which latter situation the dil tation forms the fossa navicularis), and is greatly constricted at the meatus. transverse section is elongated from side to side except within the glans penis, whe it is elongated vertically. On its walls, and more particularly on its floor, are the ope ings of numerous mucous glands, the glands of Littre, which openings are directed fo wards, and are sometimes large enough to intercept the passage of small catheter this is especially the case with one of them, which is situated on the upper wall of t fossa navicularis, and which constitutes the lacuna magna. On the floor of its pc terior dilated portion comprised within the bulb, and sometimes termed the bulbo portion, are the openings of the ducts of Cowper's glanc

STRUCTURE — Three coats: -

Mucous Coat – Thin, pale in the prostatic portion, rosy in the membranous & spon portions, in which it is thrown into longitudinal folds (except when the canal distended with urine). Covered with columnar epithelium except in the fos navicularis, where the epithelium is squamous. Presents the glands of Litt above described, which glands are most abundant in the spongy portion, ar presents also, near the meatus, a few papill

Muscular Coat – Consists of external longitudinal & internal circular unstriped mu cular fibres, both most abundant in the prostatic portio

Erectile Coat – Thick in the spongy portion, where it forms the corpus spongiosu (Vide Structure of the Penis). From this a thin layer of erectile tissue is pr longed upwards round the membranous & prostatic portions as far as the ne of the bladder, forming in the prostatic portion, according to Kobelt, the ver montanum or caput gallinagini

TRUCTURE of the PENIS.

Consists of three cylindrical masses of erectile tissue contained in strong fibrous sheaths, of which masses of erectile tissue, two, the *corpora cavernosa,* are placed side by side along the upper part of the penis, and one, the *corpus spongiosum,* which encloses the terminal portion of the urethra, lies below & between the former on the under surface of the organ.

CORPORA CAVERNOSA — Arise from the anterior & inner part of the two ischial tuberosities, and from the ascending rami of the ischia & descending rami of the pubes, by two pointed prolongations, the *crura penis.* These pass forwards & inwards, present a slight enlargement, the *bulb of the corpus cavernosum,* and unite to form the body of the penis. – The body of the penis presents on its upper surface a narrow median groove for the dorsal vessels & nerves of the organ, and, on its under surface a broader groove, which receives the corpus spongiosum. It ends anteriorly in a rounded extremity overlapped by the base of the glans.

CORPUS SPONGIOSUM — Commences between the two converging crura of the corpora cavernosa by an expanded portion, the *bulb of the urethra.* This latter is penetrated superiorly by the membranous portion of the urethra, is marked inferiorly by a partial division into two lobes, and is surrounded by the accelerator urinæ muscle & by a prolongation of the anterior or descending layer of the deep perinæal fascia. – It passes forwards, as an erectile tube, round the spongy portion of the urethra, and terminates in the *glans penis,* a conical enlargement, which overlaps the anterior rounded extremity of the two corpora cavernosa.

STRUCTURE of the CORPORA CAVERNOSA & SPONGIOSUM — They consist of:

Fibrous Investment – Thick, dense, firm, especially over the corpora cavernosa, highly elastic, but incapable of more than a certain degree of distention; formed of white & yellow elastic fibrous tissues and of unstriped muscular fibres disposed longitudinally in the superficial strata, circularly in the deeper ones.

It forms but an incomplete septum between the two corpora cavernosa in their points of contact: – The septum is thick & imperforate behind, but it only consists in front of a few vertical bands arranged somewhat like the teeth of a comb, and forming the *septum pectiniforme.*

It gives off numerous trabeculæ from its inner surface. – In the corpora cavernosa the trabeculæ are strongest towards the periphery, and the compartments they bound are transversely or circularly disposed & largest towards the centre. In the corpus spongiosum the trabeculæ are more delicate, and the compartments are longitudinal & more uniform, except in the glans penis where their arrangement is somewhat complex.

Erectile Tissue – Consists of afferent arteries, a venous plexus, & efferent veins.

Afferent Arteries – Are the arteries of the corpora cavernosa & the arteries of the bulb, and twigs from the internal pudic & the dorsal arteries of the penis. Some of the branches of these arteries terminate in capillary plexuses as in other parts of the body. Others, the *helicine arteries,* which are said to be especially numerous towards the root of the penis and to be wanting in the glans, become convoluted, and forming tendril-like twigs, project singly or in tufts into the venous spaces, and end in dilated extremities which are either open or closed (Müller). This is denied however by Valentin, who describes the smallest branches of the arteries as ending in wide funnel-shaped orifices, which open directly into the venous spaces.

Venous Plexus – Is very intricate. So numerous & large are the communications between the veins that the blood appears to be effused into a system of extra-vascular structures.

Efferent Veins – Some emerge from the corona glandis and from the upper & under surfaces of the corpora cavernosa, and join the dorsal vein of the penis; most pass out at the root of the penis, and join the prostatic plexus & the pudic veins.

The proper nerves of the cavernous structures are derived mainly from the pelvic & prostatic plexuses of the sympathetic, but partly also from the pudic nerve.

THE TESTICLE & EPIDIDYMIS.

THE TESTICLE

Is oval & compressed laterally, and so suspended by the spermatic cord as to present

Upper Extremity – The largest, directed forwards & outwards. Presents a small ped culated body, the hydatid of Morgagni, probably a remnant of Muller's d

Lower Extremity – The smaller, directed backwards & inwards.

Lateral Surfaces – Looking respectively forwards & inwards, and backwards & outwa

Anterior Border – Convex, directed forwards, downwards & outwards. – All these pa are free, smooth, and entirely invested by the tunica vaginalis prop

Posterior Border – Straight & flattened, directed backwards, upwards & inwards, cove by the epididymis & vas deferens, and only partly invested by the tunica vagina

The left testicle lies a little lower than the right one, and is frequently a li lar

THE EPIDIDYMIS

Lies on the posterior border and back part of the outer surface of the testicle, and the vas deferens on its inner side. It prese

Globus Major or Head – Its upper enlarged extremity, connected to the testicle by efferent ducts of the lat

Body – Free, surrounded by the tunica vaginalis, which dips in between it & the test along its outer border, and connects its inner or posterior border to the poste border of the test

Globus Minor or Tail – Its lower pointed extremity, attached to the testicle by d fibrous tis

The tunica vaginalis covers the whole of the upper or outer surface of epididymis, as well as the under surface of its body. – The vas a rans of Haller communicates with the canal of the epididymis or the commencement of the vas defer

TRUCTURE of the TESTICLE & EPIDIDYMIS.

STRUCTURE of the TESTICLE — Presents for examination; –

THREE IMMEDIATE COVERINGS: —

Tunica Vaginalis – Vide Coverings of the testicle.

Tunica Albuginea – Thick, dense, bluish-white, fibrous membrane, covered externally by the tunica vaginalis propria except along the points of attachment of the epididymis & vas deferens, and reflected into the interior of the testicle along its posterior or upper border in the shape of an incomplete vertical septum, the mediastinum testis or Corpus Highmorianum. This latter body supports the vessels & nerves and the excretory ducts of the testicle in their passage to or from the gland, and gives off numerous trabeculæ, which radiate towards the whole extent of the inner surface of the tunica albuginea, and inclose the numerous pyramidal spaces containing the lobules of the gland substance.

Tunica Vasculosa or Pia Mater Testis – Consists of a plexus of blood-vessels held together by delicate areolar tissue, and formed by the subdivision of the superficial set of brs. of the spermatic artery. Branches given off by this plexus, penetrate into the substance of the gland, supported by the trabeculæ.

PROPER SUBSTANCE or PARENCHYMA

— Consists of numerous pyramidal lobules contained in the pyramidal spaces bounded by the trabeculæ, and presenting a base directed towards the surface of the testicle and an apex directed towards the mediastinum. Of these lobules the central ones are the largest. The degree to which the lobules are isolated by the trabeculæ is somewhat variable, hence the different estimates of their number, 250 (Berres), 400 (Krause).

Each lobule consists of from *one to three or more tubuli seminiferi*, the number & the length of which tubuli has also been variously estimated,– 300, sixteen feet in length (Monro), 840, two feet & a quarter in length (Lauth). – The diameter of the tubuli is from $\frac{1}{200}$ to $\frac{1}{150}$ of an inch. They consist from without inwards of a delicate fibro-areolar coat, a basement membrane, and sometimes a layer of granular nucleated epithelium. The epithelium is absent, however, when the gland is particularly active; the tubuli are then filled with cells of different sizes without any regular arangement.

The *tubuli seminiferi* commence towards the surface of the testicle, sometimes by free cœcal or blind extremities, but more commonly by anastomatic loops. They are exceedingly convoluted in the peripheral part of the gland; their convolutions are of two orders, viz., a fine & regular undulation giving a granular appearance to the whole of their mass, and a more complicated folding of the undulating tube. Towards the apices of the lobules they become straighter, and they coalesce into from twenty to thirty straight tubes the *vasa recta*, which are from $\frac{1}{100}$ to $\frac{1}{60}$ of an inch in diameter.

The *vasa recta* enter the mediastinum, and passing upwards & backwards, they form within that body a network of anastomosing tubules, the *rete testis* or *rete vasculosum testis*.

The rete testis is continued superiorly into from twelve to fifteen or twenty *vasa efferentia*

The *vasa efferentia* perforate the tunica albuginea at the upper & back part of the testicle. In their extra-testicular course, which is about 6 or 8 inches long, they are at first straight & relatively wide, but they soon become convoluted & slightly narrowed, and form a series of conical masses, the *coni vasculosi*, which latter constitute together the globus major of the epididymis. They are lined with ciliated epithelium.

The excretory ducts of the testicle open finally into the commencement of the canal of the epididymis at apparently narrow intervals, which intervals however, are seen, when the canal of the epididymis is unravelled, to measure from two to three inches in length.

STRUCTURE of the EPIDIDYMIS

— The epididymis consists of a single tube about twenty feet long, by which the tubuli seminiferi open into the vas deferens. It is at first very thin & exceedingly convoluted, and of a diameter of about $\frac{1}{70}$ of an inch. It diminishes a little in size for a short distance, but it soon increases considerably, the thickness of its walls increasing also, and its course becoming less tortuous. A little fine areolar tissue binds its convolutions together, thicker septa being interposed between the larger masses of coils termed *lobes*, which latter are mostly transverse in direction. The epithelium of the canal of the epididymis is ciliated (Becker, Kölliker). – The Vas aberrans of Haller (Vide spermatic cord) is usually connected either with the canal of the epididymis or with the commencement of the vas deferens.

THE VAS DEFERENS, VESICULÆ SEMINALES, & EJ CULATORY DUCT

VAS DEFERENS

Ascends on inner side of epididymis along lower three-fourths of posterior border of ticle, to which it is attached by firm areolar ti

Along back of spermatic cord to external abdominal ring;

Through external abdominal ring, inguinal canal & internal abdominal ring;

Downwards, backwards, inwards to base of bladder, passing on outer side of epigast obliterated hypogastric arteries and then on inner side of ur

Forwards & inwards between bladder & rectum, along inner side of vesicula semi becoming enlarged & saccula

Narrows to a point, and joins opposite base of prostate with duct of corresponding cula seminalis, to form the common seminal or ejaculatory

Its canal is very small. Its walls are very thick & dense, and consist from wit inwards of a cellular coat, of a muscular coat presenting two longitudinal laye an intermediate circular layer of fibres, and of a mucous coat covered with co nar non-ciliated epithel

The vas aberrans of Haller communicates with the canal of the epidid or with the commencement of the vas defer

VESICULÆ SEMINALES

Two lobulated membranous pouches about 2½ inches long obliquely disposed bet base of bladder & second part of rectum, and present

Post. Diverging Extremities – Enlarged, and reach as far back as mination of ure

Ant. Converging Extremities – Pointed; join at base of prostate with ter ation of the corresponding vas deferens to form the common semin ejaculatory

Upper Surface – In contact with base of bladder.

Under Surface – Rests upon second part of rectum, from which it is s rated by a process of the recto-vesical layer of the pelvic fa

They have the enlarged & sacculated vasa deferentia to their inner side, and bo laterally a triangular portion of the base of the bladder which corresp to trigonum ves

Each vesicula seminalis consists of a tube from four to six inches long, and of about diameter of a crow quill. This tube is irregularly coiled upon itself, gives off numerous cœcal diverticula, which, as well as the coils of tube, are bound together by firm areolar tissue. Its walls are thin, consist of fibrous, muscular & mucous coats, the epithelium of the la being squam

EJACULATORY DUCTS

Two small canals about ¾ of an inch in length formed by the junction opposite the of the prostate of the vas deferens with the duct of the vesicula semin

They pass forwards & inwards through the substance of the prostate along the sid the verumontanum, and terminate by a slit-like opening upon or within the gins of the vesicula prostatica or sinus pocul

Their walls are thin, and consist of a delicate fibrous coat & of muscular & mucous c

HE PROSTATE GLAND

Is a pale firm glandular structure of about the size & shape of a horse-chesnut, situated beneath the trigonum vesicæ and around the neck of the bladder & commencement of the urethra; below and behind the symphysis pubis & the pubo-prostatic ligaments or anterior true ligaments of the bladder; above & in front of the second part of the rectum and the point of decussation of those anterior or inner fibres of the levator ani which form the levator prostatæ; between the two lateral halves of the posterior or ascending layer of the deep perinæal fascia or triangular ligament, and between the two lateral halves of the ascending portion of the recto-vesical layer of the pelvic fascia.

It measures normally from 1¼ to 1½ inches in its antero-posterior diameter, 1⅝ inches in its greatest transverse diameter (Sir H. Thompson), and about ⅝ of an inch in depth; these measurements undergo, however, great variations in old persons, who are frequently the subjects of enlarged prostate.

It consists of two lateral lobes separated behind by a deep notch, and of a third or middle lobe which is normally but a small rounded or triangular mass fitted in between the two lateral lobes in the under part of the organ, and lying between the ejaculatory ducts immediately beneath the neck of the bladder. The degree of development of this middle lobe, is however, very variable, it being often much enlarged in advanced life, and then projecting into the neck of the bladder so as to impede the passage of urine.

It presents for examination:

BASE — Directed backwards & upwards towards the trigonum vesicæ & the neck of the bladder, and notched posteriorly.

APEX — Passes downwards & forwards between the posterior or ascending layers of the deep perinæal fascia or triangular ligament.

UPPER SURFACE — Covered by and connected to the pubo-prostatic ligaments or ant. true ligaments of the bladder and the front part of the recto-vesical layer of the pelvic fascia. Is situated about ⅝ of an inch below & behind the symphysis pubis, and presents a slight longitudinal furrow.

UNDER SURFACE — Rests upon the lower part of the second portion of the rectum (just opposite the bend between the second & third portions), a process of the recto-vesical layer of the pelvic fascia being interposed between the two organs. Presents a slight depression, or sometimes two converging grooves which correspond to the ejaculatory ducts and which demarcate the central lobe.

LATERAL SURFACES — Covered by the layers of fascia above mentioned, by those anterior or inner fibres of the levatores ani which go to form the levator prostatæ, and by the reflections of the peritoneum from the bladder to the sides of the pelvis which reflections form the lateral false ligaments of the bladder.

It is perforated by the urethra, which usually lies nearer its upper than its lower surface, and also by the ejaculatory ducts which pass forwards & inwards through the lower part of the gland along the side of the verumontanum, and terminate by a slit-like opening upon or within the margins of the vesicula prostatica or sinus pocularis.

STRUCTURE — Structurally the prostate presents:

Fibrous Capsule — Distinct from the fibrous investment derived from the two halves of the posterior or ascending layer of the deep perinæal fascia & from the recto-vesical layer of the pelvic fascia, and separated from these by prostatic plexus of veins. It sends off fibrous prolongations into the interior of the gland.

Glandular Subtance — Consists of follicular pouches which are grouped around, and open into, numerous elongated canals, by the junction of which from twelve to twenty excretory ducts are formed; these open into the prostatic sinus on the floor of the prostatic portion of the urethra.

Muscular Fibres — Are abundant in the fibrous capsule. The urethra is surrounded, as it passes through the prostate, by a thick layer of circular fibres continuous behind with the fibres of the sphincter vesicæ, and in front with those of the membranous portion of the urethra.

Vessels & Nerves — Arteries are derived from the internal pudic, vesical & middle hæmorrhoidal. Veins form an important plexus around sides & base of prostate: they receive in front the dorsal vein of the penis, and open behind into internal iliac vein. Lymphatics ramify on the outer surface of the capsule. Nerves are derived from hypogastric plexus.

COVERINGS of the TESTICLE

Are the :-

Scrotum - Consists of two layers :

Integument - Thin & brownish; presents a few sebaceous follicles & thinly scattere crisp hairs, and is divided into two lateral halves by a median raphé, whic raphé is continued forwards on under surface of penis and backwards alon middle line of perinæum to anus. Is closely applied to the testes and is corr gated transversely when the dartos is contracted, that is to say, usually in th young & robust, and in all under the influence of cold, and is elongated flaccid when the dartos is relaxed, that is to say, usually in the debilitated aged, and in all under the influence of warmt

Dartos - Is a thick stratum of loose reddish tissue, a modification of the superfici fascia of the surrounding regions, consisting of areolar tissue with numero superadded muscular fibres and without any fat; it sends inwards betwee the two testicles a septum, the *septum scroti,* which divides its cavity into two. It is contractile, but its contractility is slow in its action, and especially excite by cold, not by electricit

Intercolumnar or External Spermatic Fascia - Thin cellular layer derived fro the margins of the external abdominal ring during the descent of the testis, a continuous above with the intercolumnar fibres, which bound that ring superiorl

Cremasteric Fascia - Consists of the scattered bundles of fibres of the cremaster & intern oblique muscles united by a little areolar tissu

Fascia Propria - Relatively thick layer, the continuation of the infundibuliform process the fascia transversalis, which layer supports both the cremasteric fascia & t tunica vaginalis reflex

Tunica Vaginalis - Is derived from the peritoneum, of which it is at first a continuatio but from which it is subsequently cut off by the closure of that part of the peritone pouch, which extends from the internal abdominal ring to a short distance from t testicle. - Is divided int

Visceral Portion or Tunica Vaginalis Propria - Surrounds the testicle, and cove both the upper or outer surface of the epididymis and also the under surface its central part or body, penetrating, along its outer border, between it & t testicle, and thus forming the *digital foss*

Parietal Portion, or Tunica Vaginalis Reflexa - Is reflected from the posterior bo der of the testicle upon the inner surface of the fascia propria, extendin however, a short distance up the cord upon its anterior & inner aspect

THE SPERMATIC CORD

Consists of the portion of the vas deferens which extends from the testicle to the internal abdominal ring, and of the accompanying arteries, veins, lymphatics, & nerves and contains the vas aberrans & the organ of Giraldes. These structures are bound together by delicate areolar tissue, and are invested from within outwards by:

Tunica vaginalis, below;
Fascia propria, along the whole
Cramasteric fascia, along nearly the whole of the course of the cord;
Intercolumnar fascia, dartos & skin of the scrotum, below the external abdominal ring.

Vas deferens – Lies at the back.

Arteries – Are the *spermatic,* the *artery of the vas deferens* from the superior vesical, and the *cremasteric* branch of the epigastric.

Veins – Are the spermatic veins, which pass up in front of the vas deferens, forming the *pampiniform plexus,* and then unite in a single trunk, which accompanies the abdominal portion of the spermatic artery and terminates in the left renal vein, on the left side, in the inferior vena cava, on the right.

Lymphatics – Terminate in the lumbar glands.

Nerves – Are the *ilio-inguinal,* the *genital branch of the genito-crural,* frequently a branch of the ilio-hypogastric, and the *spermatic plexus of the sympathetic,* which latter is derived from the renal, aortic & hypogastric plexuses.

Vas Aberrans (Haller) – A narrow tortuous tube from 1½ to 14 inches long, connected with the commencement of the vas deferens or with the lower part of the canal of the epididymis, and passing upwards for 1 or 2 inches among the other vessels of the spermatic cord. It ends in a blind extremity, and is sometimes unconnected with the seminal ducts. It was probably connected in the fœtus with the Wolffian body.

Organ of Giraldes – A collection of minute convoluted tubules, probably a remnant of the Wolffian body, found in the lower & front part of the cord close to the head of the epididymis.

THE SUPRARENAL CAPSULES.

Small yellow or brownish crescentic flattened bodies, weighing from one to two drachms each, which lie o upper & front part of kidney. – The right one is nearly triangular, lies a little lower, and is somewha smaller; the left one is more semilunar, lies a little higher, and is somewhat larger. They present:

Anterior Surface – Covered on right side by right lobe of liver, on left side by tail o pancreas & spleen. Presents a small fissure, the hilum, from which the suprarenal vein emerges

Posterior Surface – Rests upon crus of diaphragm opposite 10th dorsal vertebra.

Lower Border or Base – Thick, concave, rests upon upper & front part of kidney.

Upper Border – Thin, convex, directed upwards & inwards. In relation internally wit great splanchnic nerves & semilunar ganglia; and also with the aorta, on the left side and with the inferior vena cava, on the right side

STRUCTURE.

Three opinions are still held: – (1) The suprarenal capsules are vascular or ductless glands; (2) they form part of the sympathetic system; (3) their cortical substance constitutes a ductless gland, while their medullary substance is an appendix to the nervous system. The latter opinion is that of Kölliker. – They present for examination: –

Fibrous Capsule. – Thin, and easily torn; sends numerous processes inwards. Its deeper strata appear particularly rich in connective tissue corpuscles, but deficient in elastic fibres.

Cortical Substance. – Firm, striated, of a deep yellow colour, separated from the medullary substance by a layer of loose cellular tissue; forms the greater part of the organ. It may be divided into one principal or relatively wide & intermediate layer or zone, the *zona fasciculata*, and two narrower or secondary zones, one external, the *zona glomerulosa*, one internal, the *zona reticularis* (J. Arnold).

The principal or wide & intermediate zone, or *zona fasciculata*, consists of column-like groups of cells arranged perpendicularly to the surface, and supported by a relatively strong fibrous stroma. The groups of cells are about $\frac{1}{700}$ of an inch in diameter. The cells of which they are formed vary from $\frac{1}{2000}$ to $\frac{1}{1350}$ of an inch. They are polyhedral or many-sided through mutual pressure, finely granular, and scarcely stained by solutions of yellow chromate of potash; they contain a clear round nucleus, and frequently a few yellowish oil-globules.

The columnar arrangement is wanting in the outer & inner zones. In both, the groups of cells are more rounded, and the stroma more equally distributed. In the outer zone *(zona glomerulosa)* are found oval spaces, of which it is difficult to say whether they communicate with the extremity of the columns or not. The inner zone *(zona reticularis)* in the darkest part of the cortical substance.

Medullary Substance – Absent from the edges & from the thin upper part of the adult organ; probably everywhere present in the early condition. Much darker than the cortical substance: frequently of that brownish black hue which gave rise to the name of "atrabiliary capsules" formerly given to these organs. Also much softer: sometimes quite pulpy, and so easily lacerated that, by some anatomists, a central cavity was described in the interior. Consists of groups of cells supported by a delicate stroma, the main points of interest in respect of which cells are the distinctions between them & the cells of the cortical substance, and their supposed connexion with nerve-fibres: They are coarsely granular & destitute of oil globules, and they are stained deeply by solutions of yellow chromate of potash. Some of them are branched, and their processes are said by Lushka to be continued into nerve-fibres. Hence they would be nerve-cells (Leydig, Lushka). This is denied, however, by other anatomists, who admit nevertheless that *some* of the cells of the medullary substance are ganglion-cells placed in the course of nerve-fibres. The opinion of Kölliker is given above.

Arteries – Are the suprarenal brs. of the abdominal aorta, renal, & inferior phrenic. Entering from the surface generally, they first pass up between the columns of the cortical substance, enclosing each column in fine elongated capillary meshes. A network of more rounded meshes pervades the medullary substance.

Veins – Converge from the centre of the organ towards the hilum on the anterior surface, which they generally leave as one trunk. They open on the right side into the inferior vena cava, on the left side into the left renal.

Lymphatics – Are but imperfectly known. They may be divided into superficial & deep. They open into the lumbar glands.

Nerves – Are exceedingly numerous, and are derived from the solar & renal plexuses, and, according to Bergmann, from the phrenic & the pneumogastric nerves. They enter mainly towards the inner border & the base. – They pass up between the columns of the cortical substance, which they do not appear to supply. They then spread out in the zona reticularis and enter the medullary substance, where they form a complicated network. They consist mainly of medullated fibres. Numerous small ganglia are formed upon them, both outside & within the organ.

THE FEMALE GENITO-URINARY ORGANS.

THE MAMMA.

Rudimentary in the male, small in the female before puberty; increases in size during pregnancy & after delivery. – Presents:

POSTERIOR SURFACE, or BASE — Somewhat concave; nearly circular, but slightly elongated from below upwards & outwards. Rests upon pectoralis major & fascia covering it, and extends from 3rd rib to the 6th or 7th, and from side of sternum to axilla.

ANTERIOR SURFACE — Presents, a little below its middle, the nipple surrounded by the areola.

Nipple – Cylindrical or conical; presents at its apex the openings of the lactiferous ducts. Its surface is of a pink or brownish hue, wrinkled, provided with papillæ, and, near its base, with some sebaceous glands. It is susceptible of a sort of erection due mainly to the contraction of its muscular fibres.

Areola – Rosy in the virgin; larger & darker in colour after the second month of pregnancy & during lactation (when its sebaceous glands enlarge considerably), and also somewhat so during the remainder of life.

STRUCTURE of the MAMMA — Presents:

Mammary Gland – Compound conglomerate gland, pale, firm, of same shape as, but smaller than, the breast taken as a whole. Each of its several lobes consists of lobules, themselves made up of acini & of small excretory ducts, the latter uniting to form larger ones. The large excretory ducts, *tubuli lactiferi or galactophori*, from fifteen to twenty in number, converge towards the areola, beneath which they form dilatations or ampullæ, which serve as reservoirs for the milk. At the base of the nipple they become contracted, and they then pursue a straight course to its apex, where they end by separate apertures considerably narrower than the ducts themselves. – The nipple contains numerous blood-vessels intermixed with plain muscular fibres.

Fibro-Areolar Tissue – Forms a firm capsule to the gland & septa between its lobes, and surrounds the organ, except beneath the areola & nipple, with a thick stratum of adipose tissue, which greatly increases its size.

Vessels & Nerves – ARTERIES. From the thoracic branches of the axillary, the intercostals, & the internal mammary. – VEINS. Form an anastomotic circle round the base of the nipple, from which circle large branches radiate towards the circumference of the gland, and end in the axillary & internal mammary veins. – LYMPHATICS. Open into the glands along lower border of pectoralis major. – NERVES. From anterior & lateral cutaneous nerves of the thorax.

THE VULVA.

Comprises all the external genitals of the female, i.e.: -

Mons Veneris - Rounded eminence in front of pubes, formed by a collection of adipose tissue, and covered with hair after puberty.

Labia Majora - Two prominent folds, thickest in front, formed externally of integument, internally of mucous membrane, and containing a large quantity of areolar & dartoic tissues, which folds are joined together at the mons Veneris, where they form the *anterior commissure*, and also in front of the perinæum proper, where they form the *posterior commissure* and bound posteriorly the *fossa navicularis*, which latter fossa is bounded anteriorly by the *fourchette*.

Labia Minora or Nymphæ - Two small folds of mucous membrane, narrow inferiorly, where they become lost on inner surface of foregoing, broad superiorly, where, dividing, they embrace, and form the *prepuce* of, the

Clitoris - A diminutive penis in appearance & structure, presenting crura, body, glans, prepuce, suspensory ligament, & muscles analogous to those of the male, but no urethra, the female urethra being imbedded in the anterior wall of the vagina, and its

Meatus Urinarius - Lying somewhat prominently about an inch below clitoris, at lower part of vestibule.

Vestibule - A triangular depression bounded laterally by the nymphæ and inferiorly by the

Aperture of the Vagina - Which latter is surrounded by the sphincter vaginæ muscle, and is partly closed in the virgin by the

Hymen - A fold of mucous membrane usually semilunar with free concave border turned upwards towards pubes; sometimes absent; sometimes developed into a septum, complete, or with small central, or numerous cribriform apertures; replaced after sexual connection by the *carunculæ myrtiformes*, small irregular eminences due to the cicatrisation of the ruptured hymen.

BLADDER, URETHRA, RECTUM.

BLADDER — Is normally smaller than in the male, though sometimes larger through distention, and is very broad from side to side. Its posterior surface comes in contact with the uterus, and its base rests upon the vagina & the lower part of the cervix uteri. Its other relations are the same as in the male.

URETHRA — Is about an inch & a half long and very dilatable. It passes downwards & forwards in the anterior wall of the vagina, being slightly curved with concavity upwards. It perforates the triangular ligament as in the male, and is surrounded by the compressor urethræ muscle. – In structure it presents from without inwards: –

1. *Muscular coat* – Consists of a thick layer of circular fibres continuous with those of bladder.
2. *Thin layer of erectile tissue.*
3. *Mucous membrane* – Covered with squamous epithelium, except near the bladder, where the epithelium is spheroidal, and thrown into numerous longitudinal folds, of which one, situated on the floor of the canal, more or less resembles the verumontanum of the male.

RECTUM — Is less curved and more capacious. The first & third portions are similar to what they are in the male. The second portion is adherent inferiorly to the posterior wall of the vagina, and superiorly is less completely invested by peritoneum.

THE VAGINA

Curves downwards & forwards, following at first axis of pelvic cavity, then axis of its outlet. – Four inches long along anterior wall, five or six along posterior wall, which latter is attached to cervix uteri higher up than the anterior. Dilated at its uterine extremity, constricted at vulva.

Its *anterior wall* supports urethra & base of bladder.

Its *posterior wall* is covered in its upper fourth by peritoneum of recto-vaginal pouch, and rests in its lower three-fourths upon anterior wall of rectum.

Its *sides* give attachment superiorly to broad ligaments, inferiorly to levatores ani & recto-vesical layer of pelvic fascia.

STRUCTURE — Three coats, from without inwards: –

Muscular – Consists of external longitudinal & deep circular fibres, partly continuous superiorly with superficial fibres of uterus, partly attached to recto-vesical layer of pelvic fascia.

Erectile – Most developed inferiorly.

Mucous – Covered with squamous epithelium; elevated into two prominent ridges, one in front, one behind, the *columns of the vagina*, which are most prominent inferiorly, and from which smaller transverse ridges pass outwards on either side.

BULBUS VESTIBULI, & GLANDS OF BARTHOLIN.

The former are two oblong masses of erectile tissue corresponding to the two halves of the bulb in the male; they are about an inch long, rounded below and behind, where they lie on either side of the opening of the vagina, narrow above & in front, where they are connected to the crura clitoridis & to the rami of the pubes. – Just in front of each is another smaller mass of erectile tissue, continuous both with the bulbus vestibuli & with the clitoris, and regarded as corresponding to the part of the male corpus spongiosum, which lies in front of the bulb; it is termed the *pars intermedia* (Kobelt).

The glands of Bartholin lie on either side of the opening of the vagina behind the posterior extremity of the foregoing; they are oblong, of a reddish colour, and of the size of a small bean; their ducts open on the inner side of the nymphæ externally to the hymen. They correspond to Cowper's glands in the male,

THE UTERUS.

Pear-shaped & flattened from before backwards.
Lies between bladder & rectum, projects inferiorly into upper end of vagina, and is retained in position by its broad & round ligaments. Presents: -

Fundus - broad & rounded, directed upwards & forwards, covered with peritoneum; lies a little below level of brim of pelvis.

Body - Narrows gradually from fundus to neck, and presents:

Anterior Surface - Flattened, covered by peritoneum in its upper three-fourths, adherent to bladder in its lower fourth.

Posterior Surface - Convex, entirely covered by peritoneum, and separated from rectum by convolutions of small intestine.

Lateral Margins - Rounded from before backwards, concave from above downwards. Give attachment superiorly to the Fallopian tube, and below that tube, to the round ligament in front, & the ligament of the ovary behind.

Cervix, or Neck - Constricted. Gives attachment to upper end of vagina, which canal extends a greater distance upwards behind than in front.

Vaginal Extremity - Free. Presents the *os uteri* bounded by a thick anterior, and a long & narrow posterior lip.

Cavity - Very small in comparison with size of organ, and flattened from before backwards; triangular in body, fusiform in neck, the two parts of the cavity being separated by a constriction, the *os internum*, somewhat narrower than the *os externum.*- The cavity of the body is prolonged at each superior angle into an infundibuliform process, at the apex of which is the minute opening of the Fallopian tube. The cavity of the cervix presents on each wall a prominent median raphé, *the stem*, from which small oblique rugæ, *the branches of the arbor vitæ*, proceed upwards & outwards. The so-called *ovulæ Nabothi*, closed & distended follicles at one time mistaken for ova, are frequently seen among the above rugæ.

LIGAMENTS OF THE UTERUS — Eight in number of which six, the anterior, posterior, & transverse, are formed by the peritoneum.

Round Ligaments - V. next Tablet but one.

Anterior Ligaments - The margins of the utero-vesical pouch of the peritoneum.

Posterior Ligaments - The margins of recto-vesical pouch.

Transverse or Broad Ligts.-Formed by the peritoneum extending from side of uterus to side of pelvis; their free margin contains from before backwards the round ligament, Fallopian tube, & ovary.

STRUCTURE of the UTERUS.

Presents three coats, serous, muscular, mucous, and vessels & nerves.

SEROUS COAT — Covers fundus, posterior surface, & upper three-fourths of the anterior.

MUSCULAR COAT — The chief bulk of the organ, thickest opposite middle of body & fundus, thinnest opposite Fallopian tubes; dense, firm, & greyish in the unimpregnated state, softer, & more highly coloured during gestation. Consists of plain muscular fibres abundantly intermixed, especially near the surface, with fibro-areolar tissue, and disposed in three layers as follows:

Outer Layer – Thin stratum of transverse fibres, which, on both surfaces of the organ, converge towards its superior angles, and are from thence prolonged upon the round ligament, the Fallopian tube, & the ligament of the ovary, and into the broad & posterior ligaments of uterus.

Middle Layer – Thick irregular stratum of fibres crossing each other in all directions.

Inner Layer – Forms complete circular rings round the two infundibuliform prolongations of the cavity of the uterus towards the Fallopian tubes, rings individually incomplete, but completed by those of the opposite side, round the body of the organ, and finally a transverse band round the cervix.

MUCOUS COAT — Thin, smooth, firmly adherent, covered with columnar ciliated epithelium, except in lower part of cervix near os externum, where the epithelium becomes squamous; presents numerous follicles, which, in the body of the organ, are long tubular glands arranged perpendicularly to the surface, and of which, among the rugæ of the cervix, a few are frequently seen to be closed & distended by their own secretion, forming the so-called *ovulæ Nabothi.*

VESSELS & NERVES — Arteries. Are the uterine, & twigs from the ovarian; they anastomose frequently, and are very tortuous in their course. – Veins. Accompany the arteries, and are very large, especially in pregnancy, when, in the substance of the uterus, they are transformed into real sinuses. – Lymphatics. Those of the cervix open into the sacral & internal iliac glands; those of the fundus open into the lumbar glands. – Nerves. From the inferior hypogastric & ovarian plexuses, and from the 3rd & 4th sacral.

VARIATIONS of the UTERUS ACCORDING to

Age - In the infant the neck is larger than the body, and the organ lies above the brim of the pelvis. At puberty the uterus is pyriform in shape; it has descended into the pelvis, and the arbor vitæ is well marked. In old age, the uterus becomes pale, dense, & atrophied; the body & the cervix become less distinct; both the os internum & the os externum diminish in size and sometimes close; the labia of the os externum almost entirely disappear.

Menstruation - At each period, especially when menstruation is first established, the uterus becomes enlarged, & more vascular; the os externum, more rounded, & its labia turgid & swollen; the mucous membrane of the cavity, thicker, softer & darker in colour.

Pregnancy - During pregnancy the mucous membrane of the uterus becomes thick, soft, & vascular, and is soon differentiated into decidua reflexa, decidua serotina, & decidua vera. The muscular structure increases both by new formation and by the hypertrophy of its pre-existing elements until about the sixth month, the weight of the uterus increasing from about an ounce to from 1½ to 3 lbs.; the subsequent enlargement of the uterus is due to distention. In shape the body becomes more rounded and more directly continuous with the cervix, and towards the close of gestation the cervix itself becomes distended, and its cavity becomes continuous with that of the body. While thus increasing in bulk, the uterus makes its way between the layers of its broad ligaments, and, after first sinking somewhat within the cavity of the pelvis, it subsequently rises into the hypogastric region & into the lower part of the umbilical.

Parturition - Brings about the partial return to the virgin state. The weight of the uterus usually remains, however, from two to three ounces; its cavity, larger; its os externum, wider and more transverse with its margins puckered & fissured.

THE APPENDAGES of the UTERUS

Are the round ligament, the Fallopian tube, and the ovary & its ligament, which lie, in the above-mentioned order from before backwards, in the broad ligament of the uterus, the Fallopian tube occupying the free margin of that ligament. Between the ovary & the Fallopian tube is also the organ of Rosenmüller.

Round Ligament – Commences at superior angle of uterus, passes outwards & forwards between folds of broad ligament below & in front of Fallopian tube, traverses inguinal canal, and becomes lost in corresponding labium major. It contains a few muscular fibres prolonged from the uterus, & a few twigs from the ovarian arteries. In the fœtus a tubular process of peritoneum, the canal of Nuck, accompanies it in the inguinal canal; but this process is generally obliterated in the adult.

Fallopian Tube, or Oviduct – Commences at superior angle of uterus by a very minute opening, the *ostium internum*, and its canal remains very narrow along inner half of the tube. Passing outwards in free margin of broad ligament, and then curving downwards & backwards towards ovary, it gradually expands into a wide trumpet-shaped extremity *(fimbriated extremity or morsus diaboli)*, surrounded by a series of fringe-like processes, the *fimbriæ*, one of which is attached to the outer end of the ovary; the opening of which extremity, termed the *ostium abdominale*, is, however, somewhat contracted. – In structure it presents:

Serous Coat.

Muscular Coat – Consists of external longitudinal & internal circular fibres derived from the uterus.

Mucous Coat – Covered with columnar ciliated epithelium, and thrown into numerous longitudinal folds, which folds are thick & broad in the outer & wider part of the tube, and narrower & broken up into delicate arborescent processes in the inner & narrow part. This coat is continuous externally with the peritoneum.

Ovary – Vide next Tablet.

Ligament of the Ovary – Rounded bundle of fibrous tissue & muscular fibres, the latter derived from the uterus, extending from superior angle of latter organ to inner extremity of ovary.

Organ of Rosenmüller or Parovarium – A group of closed tubules lined with epithelium, scattered transversely in broad ligament of uterus between Fallopian tube & ovary, and connected together externally by a larger vertical tube, which descends for some distance along side of uterus. Is probably a remnant of the Wolffian body.

THE OVARY.

Oval, flattened from above downwards. Lies in posterior part of broad ligament, below behind the Fallopian tube; and is attached internally to the uterus by the ligament of th ovary, and externally to one of the fimbriæ of the morsus diaboli. It is whitish in colou and its surface is smooth in the child, uneven & puckered in the adult

STRUCTURE of the OVARY — Presents

SEROUS COAT — Investing the whole organ except its anterior attached margin which forms the *hilum*

FIBROUS COAT, or TUNICA ALBUGINEA — Firm, dense, enclosing the

STROMA — A reddish white vascular structure, the fibres of which, although forming felted tissue, radiate somewhat from the hilum towards the periphery of th organ. Its peripheral or cortical portion contains th

Graafian Vesicles, or Ovisacs – About 70,000 in number, varying in siz from $\frac{1}{60}$ to $\frac{1}{80}$ of an inch in diameter; from ten to twenty or thirty of the being after puberty enlarged to from $\frac{1}{20}$ to $\frac{1}{6}$ of an inch or more. Eac vesicle presents

1. *External fibro-vascular coat.*
2. *Internal coat, or ovi-capsule.*
3. *Layer of nucleated cells, the membrana granulosa.*
4. *A transparent albuminous fluid,* in which the ovum is first suspended. – When the Graafian vesicle and its contained ovum are mature the cells of the membrana granulosa are heaped up at one point into pyramidal eminence, the *discus proligerus,* in which the ovum is then found – The Graafian vesicles enlarge one after the other, and approach the surface of the ovary, forming small projections beneath the peritoneum, and at each menstrual period, one of them bursts and projects its contents into the Fallopian tube.

The *ovum,* when mature, varies in size from $\frac{1}{240}$ to $\frac{1}{120}$ of an inch i diameter. It consists externally of a thick colourless transparent envelope the *vitelline membrane* or *zona pellucida,* internally to which is the *yelk* o *vitellus,* composed of granules of various sizes imbedded in a more fluid substance. In the yelk is the *vesicula germinativa,* or *germinal vesicle,* first situated in the centre of the yelk, and then towards the periphery near the surface of the ovary. Finally this germinal vesicle presents superficially a minute spot, the *macula germinativa* or *germinal spot,* of from $\frac{1}{3500}$ to $\frac{1}{2500}$ of an inch in diameter.

The rupture of the Graafian vesicle and the subsequent process of repair of the surface of the ovary give rise to the *corpus luteum* (Vide Physiology).

VESSELS & NERVES — Arteries. The ovarian, anastomose with the uterine, and enter at the anterior or attached border of the organ. – Veins. Follow the arteries, forming the pampiniform plexus, and open on the right side into the inferior cava, on the left side into the left renal. – Lymphatics. Accompany the blood-vessels, and open into the lumbar glands. – Nerves. From the ovarian plexus of the sympathetic, the Fallopian tube also receiving a branch from one o the uterine nerves.

THE EYE.

THE EYE

Is formed of three coats or tunics and three refracting media or humours.

The outer coat is formed by the *sclerotic* and the *cornea.*

The middle coat is formed by the *choroid,* behind, and, in the anterior part of the eye, by the *ciliary processes* and the *iris,* on the outer side of which two latter are the *ligamentum pectinatum* and the *ciliar muscle.*

The inner coat forms the *retina,* which presents a prolongation non-nervous in structure, *the ciliar portion of the retina,* which latter extends as far forwards as the base of the iris.

The refracting media or humours are:—

The *aqueous humour ;*

The *lens* and its *capsule,* which are held in position by the suspensory ligament of the lens, or zonula o Zinn.

The *vitreous body* and its *hyaloid membrane.*

The External Tunic of the Eye.

The Sclerotic

Is a strong fibrous membrane thicker behind than in front, which covers the posterior $\frac{5}{6}$ of the eye.

Its *outer surface* is white and smooth. It gives attachment to the recti and obliqui muscles, and is covere in front by the conjunctiva.

Its *inner surface* is brownish. It is connected with the choroid by a very fine cellular membrane, th lamina fusca, and is marked by slight grooves for the passage of the ciliary vessels and nerves. I front, close to the cornea, it covers, and gives attachment to, the ciliary muscle, and presents a circula groove, which forms the outer wall of the sinus circularis iridis, or canal of Schlemm.

Behind, where the optic nerve penetrates into the eye, *i.e.* about $\frac{1}{10}$ of an inch to the inner side of the axis o the latter, it becomes continuous externally with the fibrous sheath of that nerve, and forms internall a thin cribriform lamella, the lamina cribrosa, which is perforated by small openings for the passag of the nervous filaments and of the arteria centralis retinæ.

In front it becomes continuous with the cornea by direct continuity of tissue, the latter membrane bein slightly encroached upon by the sclerotic, especially above and below.

A few small blood-vessels permeate the fibrous structure of the sclerotic.

The Cornea

Constitutes the anterior sixth of the outer tunic of the eye, on the front of which it forms a sligh hemispherical projection belonging to a smaller sphere.

It is nearly circular, being, however, anteriorly a little wider in its transverse than in its vertical diameter

Its circumference joins the sclerotic by direct continuity of tissue, and is slightly overlapped by the opacit of the latter, especially above and below. Its posterior surface is, therefore, rather more extensive tha the anterior, and is more exactly circular.

Its degree of curvature varies in different individuals, and is greatest in youth.

STRUCTURE OF THE CORNEA.—The cornea consists of a thick fibrous structure, the cornea proper covered in front and behind by an elastic lamina and an epithelial coating.

The Cornea Proper—is formed of fibrous tissue continuous with that of the sclerotic, with which it i structurally homologous, its fibres being, however, softer and less distinct. It is divided int frequently communicating strata about sixty in number (Bowman), between which is found homogeneous fluid material, which probably contributes to the transparency of the cornea Pressure renders the cornea opaque by deranging the relative position of the strata, and modifying their relation to the fluid between them.

The Anterior and Posterior Elastic Laminæ (Bowman)—are perfectly transparent homogeneou membranes, very thin and brittle. When they are torn they curl up with their attached surfac innermost.

The posterior elastic lamina gives attachment towards the periphery of the cornea to the fibres o white fibrous and elastic tissue (Bowman), which form the ligamentum pectinatum, give origi to the ciliary muscle, and constitute the inner wall of the sinus circularis iridis or canal o Schlemm.

The Anterior Epithelial Coating—is formed of two or three layers of transparent nucleated cells; th *posterior* of a single layer of cells only.

The blood-vessels of the cornea terminate in loops at its circumference. They are principally derived from the vessels of the conjunctiva; in man very few are derived from the ciliary vessel through the sclerotic (Kölliker).—The nerves, from 20 to 30 in number, are derived from th ciliary nerves, and pass into the cornea from the sclerotic; they at first retain their dark outline, but soon become transparent, ramify and form a net-work within the cornea proper.—

THE MIDDLE TUNIC of the EYE

Is formed by the choroid, behind, and, in the anterior part of the eye, by the ciliary processes and the iris, on the outer side of which two latter are the ligamentum pectinatum and the ciliary muscle.

The Choroid

Is a vascular and pigmentary membrane of a dark brown colour, thicker behind than in front, which lies between the sclerotic and the retina in the posterior five-sixths of the eye. It transmits the nerves and a part of the vessels, which supply the anterior parts of the eye.

Its *outer surface* is connected with the sclerotic by a fine cellular web, the lamina fusca.

Its *inner surface* is smooth and lies in contact with the retina.

Behind, it is pierced by the optic nerve.

It is continuous *in front*, opposite the fore-part of the sclerotic, with the ciliary processes, the iris, the ciliary muscle, and the ligamentum pectinatum.

STRUCTURE.—The stroma of the choroid is formed of a network of fusiform cells and of anastomosing star-shaped pigment cells (Kolliker), and may be divided into three layers as follows :—

EXTERNAL, OR VENOUS LAYER, contains a rich network of veins, the venæ vorticosæ, which form variously disposed curves, and converge towards four or five equidistant trunks, which latter issue from the eye-ball midway between the cornea and the entrance of the optic nerve. The larger branches of the short ciliary arteries pass forwards between the veins before they curve downwards to join the capillary layer.

MIDDLE, OR CAPILLARY LAYER, or tunica Ruyschiana, presents a very fine capillary plexus, the meshes of which are smaller and more delicate near the optic nerve than in any other structure, but become larger in front, in which situation they are continuous with those of the ciliary processes.

INTERNAL, OR PIGMENTARY LAYER, consists of a single layer of remarkably regular hexagonal nucleated cells placed side by side, and so loaded with epithelium that their nucleus can scarcely be perceived.

The lamina fusca contains a few star-shaped pigment cells, and is considered by Kölliker to form part of the choroid.

The Ciliary Processes

Form, with the ciliary muscle, which lies on their outer side, a thickened anterior annular portion of the second coat of the eye continuous in front with the ligamentum pectinatum and the iris, and marked on its inner or posterior surface by prominent converging plaits or folds, to which the above name is applied, which folds are intimately adherent both to the subjacent ciliary portion of the retina and suspensory ligament of the lens, the latter of which presents similar folds between which the ciliary processes of the choroid are received.

The ciliary processes consist of large and small irregularly alternating folds, numbering altogether between sixty and eighty, the number of the small folds being about one-third of that of the large ones.

Each fold or process presents a rounded inner extremity situated behind the peripheral portion of the iris, and an outer tapering prolongation which is lost on the inner surface of the choroid.

The ciliary processes are similar in structure to the choroid, but less vascular.

The Iris

Presents *a peripheral border* attached to the contiguous margins of the cornea and sclerotic by means of the ligamentum pectinatum and continuous with the ciliary processes, the ciliary muscle, and the choroid. This border is surrounded by a venous canal, the sinus circularis iridis, or canal of Schlemm ;

An inner edge, which forms the boundary of the pupil ;

An anterior surface variously coloured in different individuals, and marked by wavy converging lines ;

A posterior surface covered with a layer of dark pigment, the uvea.

STRUCTURE.—The iris consists of a stroma of circular and radiating unstriped muscular and connective tissue fibres, scattered through which are a few ramified pigment cells, and on the posterior surface of which is a thick layer of rounded pigment cells continuous with the pigmentary covering of the ciliary processes and choroid. It is still undecided whether in the adult the posterior epithelial layer of the cornea is prolonged over the anterior surface of the iris as it is in childhood. The radiating fibres of the iris are continued into the posterior elastic lamina of the cornea, forming festoon-like processes, which constitute the properly so called ligamentum pectinatum. The circular and radiating muscular fibres of the iris form what have been called respectively the sphincter and the dilator muscles. The arteries of the iris are derived from the long and anterior ciliary, and from the vessels of the ciliary processes. Its nerves are derived from the ciliary nerves, which break up in the ciliary muscle before entering the iris.

The Ligamentum Pectinatum

Is a structure first described by Hueck, which forms the principal connection between the middle and outer tunics of the eye.

It is formed of radiating fibres of elastic and connective tissue (Kölliker), which arise from the margin of the posterior elastic lamina of the cornea and from the point of junction of the sclerotic and cornea.

Some of these fibres pass into the iris, forming the festoon-like processes which constitute the properly so called ligamentum pectinatum, the others give origin to part of the fibres of the ciliary muscle, and form the inner boundary of the sinus circularis iridis, or canal of Schlemm.

The Ciliary Muscle

Is a yellowish-white ring of radiating unstriped muscular fibres, situated on the outer side of the ciliary processes and front part of the choroid.

Its fibres arise from the ligamentum pectinatum, and from the inner surface of the sclerotic close to the cornea.

They pass backwards and outwards, and join the choroid opposite and beyond the ciliary processes.

Beneath, and concealed by, the radiating fibres, is a ring of circular muscular fibres, which was long described as the ciliary ligament.

Ophthalmologists are far from being agreed as to the mode of action of the ciliary muscle. Some believe that it draws the lens and the whole ciliary apparatus forwards, and this is certainly the case in some birds (R. J. Lee) ; others believe that it relaxes the elastic suspensory ligament of the lens, and thus allows the latter to assume a more circular form (Helmholtz). The experiments of Helmholtz appear to prove that through the action of this muscle a change is produced in the shape of the lens, which change consists in an increased convexity and a projection forwards of the anterior surface of that body, and in the slightly increased convexity without or nearly without displacement, of its posterior surface.

The vascular and nerve-supply of the ligamentum pectinatum and ciliary muscle is the same as that of the iris.

THE RETINA

Is a delicate nervous membrane, thicker behind than in front, translucent and of a light pinkish colour when fresh, but becoming white and opaque very soon after death.

It lines in its posterior portion, or retina proper, the posterior $\frac{4}{5}$ of the eye, and is continued forwards as far as the base of the iris by its *ciliary portion*, a greyish membrane destitute of nervous elements, which is intimately blended with the ciliary processes, which lie in front of it, and with the peripheral portion of the suspensory ligament of the lens or zonula of Zinn, which lies behind.

Its *outer surface* is in contact with the pigmentary layer of the choroid.

Its *inner surface* rests upon the hyaloid membrane of the vitreous body.

In front the retina proper ends in a jagged margin, the ora serrata.

Behind, about $\frac{1}{10}$ of an inch to the inner side of the axis of the eye, the retina becomes continuous with the optic nerve, and presents a slight rounded eminence, the colliculus, which is formed by the expansion of the nerve fibres, and from the centre of which the arteria centralis retinæ is seen to emerge. Exactly in the centre of the posterior part of the eye, the retina presents an elliptical elevated yellowish spot, the yellow spot, macula lutea, limbus luteus of Sömmering, in the centre of which is a slight depression, the fovea centralis, formerly termed the foramen of Sömmering, on account of its presenting somewhat of the appearance of a hole.

STRUCTURE.—The retina presents for examination three layers, the membrana limitans and the fibres of Muller.

External, or Columnar Layer, or Jacob's Membrane—is formed of rods perpendicularly disposed, intermixed between which are bulbous particles or cones, of which the broad ends rest upon the granular layer, while the pointed extremities are turned towards the choroid. Both rods and cones appear to be delicate cells with granular albuminous contents (Kölliker). To the base of each cone corresponds a pyriform cell, which forms the extremity of a fibre of Müller; whether the rods are similarly connected with Müllerian fibres is uncertain.

Middle, or Granular Layer—is formed of two strata of nuclear particles and cells containing a very large nucleus (Kölliker), which strata are separated from each other by an intermediate transparent layer slightly fibrillated in the vertical direction. The outermost stratum is the thickest. The particles of the inner stratum are larger than those of the outer, and are flattened.

Internal, or Nervous Layer—consists of an outer stratum of nerve-cells, and of an inner stratum o nerve fibres, which latter stratum is formed by the expansion of the fibres of the optic nerve. The nerve-cells present from two to six ramified offsets, by which they are connected with each other with the termination of the nerve-fibres, and with the corpuscles of the internal granular layer. The nerve-fibres are continuous with those of the optic-nerve; they are disposed in small radiating and inter-communicating bundles, which form a delicate web with narrow elongated meshes. They have lost their dark outline, and consist of an axis-cylinder only. They terminate by joining the offsets of the nerve cells.

Membrana Limitans—Is an extremely thin and delicate nucleated membrane, which separates the retina from the vitreous body. On its retinal surface it receives the insertions of the delicate fasciculi of connective tissue, of which it is now believed that the inner part of the Mullerian fibres consists.

Fibres of Muller.—Their history is still incomplete. Henle, indeed, believes that they are but artificial products, the result of coagulation by re-agents. They were first described as extending vertically from the ends of both the rods and the cones to the membrana limitans, becoming connected in their course with the nuclear particles of the granular layer; their connection with the rods is, however, uncertain. It would also appear that the vertical fibres described in the inner layers of the retina are only cellular in nature.

Over the Yellow spot the nerve-fibres are absent; Jacob's membrane is formed of cones only, and these are small, though closely aggregated.

Over the fovea centralis the granular layer is absent, as are also the fibres of Muller. The retina is, therefore, very thin, so much so that the dark pigment of the choroid is distinctly seen through it, so as to give rise to the appearance of a foramen.

The Ciliary Portion of the Retina is formed of elongated nucleated cells, with flat or forked bases resting upon the membrana limitans, which cells are believed by Kölliker to correspond to the above-mentioned pyriform cells of the Mullerian fibres.

The Arteries of the Retina are derived from a branch of the ophthalmic, the arteria centralis retinæ, which pierces the optic nerve, passes forward among its fibres and through the porus opticus, and divides into four or five branches, which latter are at first situated between the retina and the membrana limitans, but soon pass between the bundles of nerve-fibres and form a delicate network in the stratum of the nerve cells. These branches extend as far forward as the ora serrata, where they form a circular capillary plexus (Kölliker), but not a distinct circular vessel, as is the case in some animals. *The veins* follow the same course as the arteries.

THE HUMOURS or REFRACTING MEDIA of the EYE

Are:

The *Aqueous Humour.*

The *Lens* and its *Capsule,* which are held in position by the suspensory ligament of the lens, or zonula of Zinn.

The *Vitreous Body* and its *Capsule or Hyaloid Membrane.*

Aqueous Humour

Differs little from water, for it contains but a very small amount of solid matter, chiefly chloride of sodium.

It fills the space between the cornea in front, and the lens with its suspensory ligament behind. This space forms in front of, and behind the iris, what used to be called respectively the anterior and posterior aqueous chambers of the eye. These terms were, however, based on an anatomical error, for the iris is now known to lie in the greatest part of its extent in immediate contact with the lens; the only space therefore which remains behind the iris to represent the posterior chamber is a narrow angular interval between the peripheral part of the iris, the suspensory ligament of the lens, and the ciliary processes.

The Lens

Is a double-convex transparent body, the convexity of which is greater on its posterior than on its anterior surface.

It is situated between the iris and the vitreous body, and is held in position by its suspensory ligament.

It is closely surrounded by its capsule.

Its *anterior surface* is in contact with the iris towards the pupil, but recedes slightly at the periphery.

Its *posterior surface* rests upon the vitreous body.

Its *circumference* is surrounded by the canal of Petit.

STRUCTURE.—The lens consists of superposed concentric layers, the density of which increases with their depth, the superficial layers being soft and almost pulpy, the central ones forming a hard nucleus.

These layers are formed of transparent flattened fibres, which adhere to each other by slightly serrated margins, and in some of which are found transparent nuclei.

They are divided in the fœtus and infant into three triangular segments, the planes of separation between which segments accurately correspond on each of the two surfaces of the lens, but do not correspond with the planes of separation of the segments on the opposite surface, being on the contrary so arranged that each plane on one surface corresponds to the interval between two of the planes on the opposite surface.

The fibres of each segment arise from the various points of the two planes bounding the segment, and pass to the periphery of the lens nearly parallel to each other. Having curved round the edge of the lens, they belong, on its opposite surface, to two different segments, and converge towards the boundary plane which corresponds to the bisecting line of the segment on the first surface. Thus the fibres do not pass from pole to pole, but from a plane on one side of the lens to a plane on the other. Those which arise near the pole on one side terminate near the peripheral extremity of a plane on the other, and vice versa.

In the adult the planes bifurcate and multiply, and the segments become more numerous. The arrangement of the fibres of each segment with respect to the planes remains, however, the same.

Capsule of the Lens

Is a transparent, structureless, elastic, brittle membrane, thicker in front than behind. When ruptured, it curls up with its outer surface innermost.

It closely surrounds the lens, from which it is, however, separated in front by a single layer of granular nucleated polygonal cells, which absorb moisture and break down soon after death, and thus give rise to the liquor Morgagni, wrongly described at one time as existing during life.

It gives attachment in front to the suspensory ligament of the lens, and is joined behind with the hyaloid membrane.

Suspensory Ligament of the Lens, or Zonula of Zinn

Is a firm, transparent, structureless membrane, which is attached in front to the fore part of the capsule of the lens close to its circumference, and which joins posteriorly the hyaloid membrane opposite the ora serrata.

Its anterior surface presents small radiating folds, the processus ciliares zonulæ, which are received between the ciliary processes of the choroid.

Its posterior surface is separated from the hyaloid membrane by the canal of Petit.

The Vitreous Body and its Capsule, or Hyaloid Membrane.

The vitreous body fills the space between the retina and the lens, both of which it supports, and for the reception of which latter it is excavated in front.

It consists of a perfectly transparent albuminous fluid, enclosed in a delicate structureless membrane, the hyaloid, from the inner surface of which it has been said, but not proved—at least not in the adult—that delicate fibres are given off to form more or less perfect septa within the fluid part.

The hyaloid membrane is connected opposite the ciliary processes with the suspensory ligament of the lens; further inwards it forms the posterior boundary of the canal of Petit; behind the lens it is intimately united with the posterior lamella of the capsule of that body.

APPENDAGES of the EYE & LACHRYMAL APPARATUS.

The appendages of the eye are the eyebrows, eyelids & conjunctiva, and the lachrymal apparatus, which latter consists of the lachrymal gland, lachrymal canals, lachrymal sac & nasal duct.

Eyebrows.—Consist of thickened integument covered with oblique hairs.

Eyelids.—Two thin movable folds, separated by the *fissura palpebrarum*, the angles of which fissure form the *external & internal canthi*. The inner canthus is expanded into the *lacus lachrymalis*, in which are seen the *caruncula lachrymalis* & the *plica semilunaris*.—The edge of each eyelid is semilunar & thick (except opposite the lacus lachrymalis), and presents internally the *papilla lachrymalis* on the summit of which is the *punctum lachrymale.*

The upper eyelid is the largest of the two, and the most movable on account of its connection with the levator palpebræ superioris.

The eyelids consist of:—

1. Integument, subcutaneous areolar tissue, palpebral portion of the orbicularis;
2. Tarsal cartilages with the palpebral & tarsal ligaments, the tendo oculi & the tensor tarsi muscle;—and also, in the case of the upper eyelid the tendon of the levator palpebræ superioris.—The superior tarsal cartilage is the thickest, and is broadest in the middle; it gives attachment to the tendon of the levator palpebræ superioris. The inferior one is narrow, and nearly uniform in breadth.
3. Palpebral portion of the conjunctiva.
4. Meibomian glands and eyelashes.

Conjunctiva.—Presents an *ocular* & a *palpebral portion*, between which are comprised the *superior* & the *inferior palpebral folds*, of which folds the former is the deepest.

Ocular Portion—Is the thinnest and least vascular, and is subdivided into:

CORNEAL PORTION—Consists almost entirely of an epithelial layer, the underlying membrane being extremely thin & transparent and intimately blended with the anterior elastic lamina of the cornea.—Its vessels form delicate capillary loops round the circumference of the cornea, over which, in the fœtus, they extend for some distance.

SCLEROTIC PORTION—Is thicker and more vascular than the foregoing, but still transparent & nearly colourless, and is loosely connected to the globe.—At the inner canthus of the eye it covers the caruncula lachrymalis and forms the *plica semilunaris.*

Palpebral Portion—Is thick, opaque, & highly vascular, and presents numerous papillæ, which, when hypertrophied, constitute the disease called granular lids.

Lachrymal Gland — Is a conglomerate gland of the size & shape of an almond, and is situated in a depression of the outer & front part of the roof of the orbit.—It presents:—

Upper convex, & *under* concave surfaces.

Posterior border—Receives the vessels & nerves of the gland.

Anterior part, or Palpebral Portion—Is separated from the remainder of the gland by a slight depression, and is adherent to the upper eyelid & conjunctiva. It gives off from 6 to 8 excretory ducts which open into the upper fold of the conjunctiva.

Lachrymal Canals—Begin at the puncta lachrymalia on the summit of the papillæ lachrymales.—They pass respectively upwards & downwards for a short distance, and then bend inwards & open into the lachrymal sac.

Lachrymal Sac—Is the upper dilated part of the nasal duct. It lies in the lachrymal groove, and is crossed in front by the tendo oculi, and behind by the reflected aponeurosis of the same, & by the tensor tarsi muscle. It consists of a fibro-elastic coat lined internally by mucous membrane.

Nasal Duct—Is a membranous canal ¾ of an inch long, contained in an osseous canal formed by the superior maxillary, lachrymal & inferior turbinated bones. It is directed downwards, backwards & a little outwards, and opens into the inferior meatus. It is narrowest towards its middle. Its inferior orifice is partly closed by a fold of mucous membrane forming an imperfect valve.

THE EAR.

THE EXTERNAL EAR

Consists of the pinna or auricle, & the external auditory canal.

Pinna or Auricle

Presents for examination the:—

Concha,—Central deep cavity, broad above, narrow below, leading into the auditory canal. It has in front of it the

Tragus,—A conical eminence frequently covered with hairs on its under surface; and behind it the

Antitragus,—A smaller eminence separated from the former by a deep notch, the incisura intertragica.—The

Helix,—The prominent curved margin of the pinna, internal to which is the

Fossa of the Helix,—A long narrow groove which follows the inner margin of the helix, and is bounded internally by the

Antihelix,—Another curved ridge broader than the helix, and which forms the posterior boundary of the concha. It bifurcates above, so as to enclose the

Fossa of the Antihelix, — A triangular depression comprised between the front part of the helix and the two divisions of the antihelix.

Lobule,—The soft pendulous portion of the auricle.

Structure of the Pinna or Auricle—Presents for examination the:

Cartilage of the Pinna.—Represents the greater part of the pinna, minus the lobule. The portions which form the concha and the tragus are also prolonged inwards to form the outer or cartilaginous portion of the external auditory canal. It is attached by dense fibrous tissue to the rough margin of the external auditory meatus of the temporal bone.

It is wanting between the tragus & the front part of the helix. It presents several fissures or slits: a vertical fissure on the lower & front part of the helix; a vertical fissure on the front part of the tragus; the helix and part of the antihelix are separated below from the antitragus by a deep vertical slit which cuts off a pendulous tail-like process, the processus caudatus; two or three irregular fissures, the fissure of Santorini, divide transversely the portion of the cartilage which enters into the structure of the external auditory canal.

Fibrous Tissue—Fills up the deficiencies of the cartilage, and bridges over the slits, forming the intrinsic ligaments.

Ligaments—The extrinsic ligaments are two in number, and connect the helix & the tragus to the root of the zygoma, and the concha to the mastoid process.

Muscles—Are:—

Extrinsic:—Attollens, Attrahens & Retrahens Aurem (v. Ms. of the Face).

Intrinsic—Are six small bands of pale muscular fibres termed:

Helicis Major—Lies vertically upon the anterior border of the helix.

Helicis Minor—Lies obliquely upon the portion of the helix, which springs from the bottom of the concha.

Tragicus—Lies vertically on the outer surface of the tragus.

Antitragicus—Extends obliquely from the outer surface of the antitragus to the processus caudatus of the helix.

Transversus Auriculæ—Radiates on the cranial surface of the pinna, from the convexity of the concha to the prominence corresponding to the fossa of the helix.

Obliquus Auriculæ—Extends on the cranial surface of the pinna, from the convexity of the concha to prominence corresponding to the fossa of the antihelix.

Integument—Is closely adherent to the cartilage, and presents numerous sebaceous glands, especially in the concha & in the fossa of the helix.—With the subjacent areolar tissue it forms entirely the lobule.

Vessels & Nerves.—The vessels are derived from, or open into, the occipital, posterior auricular & temporal; the nerves are derived from the great auricular & auriculo-temporal, and from the auricular branches of the pneumogastric & facial,

EXTERNAL AUDITORY CANAL

Is an irregular narrowing canal 1¼ inches long, and directed:—forwards & inwards,—inwards, backwards & upwards,—inwards, forwards & downwards in the first & second quarters, and in the second half of its course respectively (Sappey, Sœmmering). If, however, the pinna, and with it the outer or cartilaginous portion of the canal, be drawn upwards & backwards, the canal will be straightened to a great extent, and will then be seen to pass nearly directly forwards, inwards & slightly downwards. It is flattened from before backwards externally & from above downwards internally, and is narrowest towards its middle. Its floor is longer than its roof, owing to the obliquity of the membrana tympani.

Structure of the External Auditory Canal—The external auditory canal is formed of cartilage, fibrous tissue & bone lined by integument, and is divided into a cartilaginous & an osseous portion.

Its integument is thin and closely adherent, and presents hair follicles & sebaceous glands near the orifice, and also numerous ceruminous glands in the dense subdermic tissue of the cartilaginous portion. Its vessels are derived from, or open into, the posterior auricular, temporal & internal maxillary; its nerves are chiefly derived from the auriculo-temporal.

Cartilaginous Portion—Is about ½ an inch long. It is formed by the prolongation inwards of the portions of the cartilage of the pinna, which form the concha & the tragus, and is firmly attached to the margin of the external auditory meatus of the temporal bone. The cartilage is deficient at the upper & back part of the canal, where it is replaced by strong fibrous tissue.

Osseous Portion—Is about ¾ of an inch long. It is formed below & in front by a curved plate of bone, which results from the extension outwards of the tympanic plate or ring of the fœtal bone. Its outer end is dilated, and presents a rough margin for the attachment of the cartilage of the pinna. The circumference of its inner end is marked, except at its upper part, by a narrow groove for the insertion of the membrana tympani.

MIDDLE EAR or TYMPANUM

Is an irregular cavity compressed from without inwards, situated between the external auditory meatus and the labyrinth, between the carotid canal and the mastoid cells, between the anterior surface of the petrous bone and the jugular fossa.

Outer Wall

Is formed by the membrana tympani, and by a small portion of bone surrounding it.

The membrana tympani is nearly circular, its vertical diameter being, however, rather the largest. It is obliquely directed downwards and inwards. Its circumference is contained in a groove which surrounds, except at its upper part, the circumference of the inner end of the meatus. It is formed of three layers, cuticular, fibrous, and mucous. The handle of the malleus descends between the inner and middle layers in their upper half, and draws the membrana tympani inwards.

Behind, and in front of, the upper part of the membrana tympani are the apertures of the iter chordæ posterius, and of the iter chordæ anterius, or canal of Huguier, by which the chorda tympani enters and leaves the tympanum.

A little below the latter opening is that of the Glaserian fissure, which gives passage to the long process, or processus gracilis, of the malleus and to the laxator tympani muscle, the former being, in the adult attached by bone to the sides of the fissure.

Inner Wall presents:

A large rounded eminence, the promontory, formed by the projection inwards of the first turn of the cochlea; its surface is grooved for the passage of the branches of Jacobson's nerve.

Behind the promontory are seen, the fenestra ovalis above, and the fenestra rotunda below . The former leads into the vestibule, and is closed by the base of the stapes and its annular ligament. The latter leads into the scala tympani of the cochlea, and is closed by the membrana tympani secundaria.

Behind and between the two fenestræ is the pyramid, a small conical eminence, the apex of which presents an opening from which the tendon of the stapedius muscle, contained in the pyramid, is seen to proceed.

Above and behind the foregoing parts is a slight ridge which indicates the position of the aqueductus Fallopii as it passes backwards and then downwards in the 2nd and 3rd parts of its course.

Posterior Wall

Presents the openings of the mastoid cells.

Anterior Wall

Presents at its upper part the orifice of the canal for the Tensor tympani muscle and, below this, the opening of the osseous portion of the Eustachian tube. The two canals are separated by a thin plate of bone, the processus cochleariformis. The opening of the former is situated upon a small eminence, the anterior pyramid.

The Floor

Corresponds to the jugular fossa. It presents the small opening through which Jacobson's nerve penetrates into the tympanum.

The Roof

Is formed by a thin plate of bone, which corresponds to the anterior surface of the petrous bone.

THE OSSICLES of the TYMPANUM

Are three in number, the malleus, the incus, and the stapes.

The malleus and the incus, taking a general view of their arrangement, are elongated from above downwards, and from without inwards, and are parallel to each other and to the membrana tympani, to the upper part of which they correspond.

The malleus is situated in front of the incus, and adheres by its outer side to the membrana tympani, which it draws inwards.

The stapes is placed horizontally at the lower extremity of the incus, and is at right angles, or nearly so, with the incus and also with the malleus.

The three bones are joined by two delicate articulations; they are moved by four muscles (counting the laxator tympani minor as a muscle), and are held in position by four ligaments.

The Malleus presents a *head* which is attached to the roof of the tympanum by its suspensory ligament, and which articulates with the incus:—

A *Neck*, which gives attachment to the laxator tympani muscle (Gray, Quain).

The *manubrium* inserted between the mucous and fibrous layers of the membrana tympani;—

The *processus gracilis*, which extends forwards and outwards into the Glaserian fissure and gives attachment to the laxator tympani muscle (Sappey, Gray). In the adult it is connected by bone to the sides of the fissure.

The *processus brevis* projects outwards towards the upper part of the membrana tympani, and gives attachment to the laxator tympani minor.

The Incus presents a *body*, which articulates with the head of the malleus, and is attached to the roof of the tympanum by the suspensory ligament of the incus;—

The *long process*, which is nearly parallel to the handle of the malleus, and presents at its extremity a nodule of bone:—

The *Os orbiculare*, which is separate in the fœtus;—

The *short process* attached by the posterior ligament of the incus to the posterior wall of the tympanum.

The Stapes presents a *head* articulated with the long process of the incus:—

A *neck*, into which the Stapedius muscle is inserted;—

Two *Crura*, which connect the neck with the base;—

The *Base*, connected by its annular ligament to the margin of the fenestra ovalis.

THE MUSCLES of the TYMPANUM

Are four in number, counting the Laxator tympani minor :—

Tensor Tympani. Or.—From under surface of apex of petrous bone and from the cartilaginous portion of the Eustachian tube. Passes backwards and outwards in its canal, from whence it is reflected outwards over the processus cochleariformis.

Insert.—Into the inner part of the manubrium of the malleus near its root.—Suppld. by a br. from otic ganglion.

Laxator Tympani. Or.—From Spine of Sphenoid and from Eustachian tube ; passes backwards and outwards through Glaserian fissure.

Insert.—Into processus gracilis of malleus (Sappey), or into neck of malleus just above the processus (Gray, Quain).—Suppld. by tympanic br. of facial.

Laxator Tympani Minor. Or.—From upper and back part of meatus auditorius ext.

Insert.—Into the processus brevis and into the handle of the malleus.—Is generally considered to be only a ligament.

Stapedius. Or.—From the interior of the pyramid.—Emerges from apex of pyramid.

Insert.—Into back of neck of stapes.—Suppld. by tympanic br. of facial.

ACTIONS. The *Tensor tympani* draws inwards the manubrium of the malleus, and consequently the membrana tympani, and thus increases the tension of the latter. The *Laxators* produce the contrary effect. The *Stapedius* inclines the stapes backwards, and is believed to compress the fluid contents of the vestibule.

Vessels and Nerves of the Tympanum.

Arteries. The tympanic, from the internal maxillary, and the stylomastoid, from the posterior auricular, form a vascular circle round the membrana tympani.—The other arteries are small ; they are the petrosal branch of the middle meningeal entering through hiatus Fallopii, twigs from internal carotid perforating posterior wall of carotid canal, twigs from ascending pharyngeal ascending along Eustachian tube.

Veins. Join middle meningeal and pharyngeal veins.

Nerves. Are :—a filament from otic ganglion to tensor tympani ;—tympanic branch of facial, to stapedius and laxator tympani ;—tympanic branch of glosso-pharyngeal or Jacobson's nerve, supplies mucous membrane of tympanum, and gives off branches of communication to carotid plexus, great petrosal nerve and otic ganglion ;—chorda tympani.

THE INTERNAL EAR or LABYRINTH

Consists of a series of cavities, the osseous labyrinth, channelled out of the substance of the petrous bone, lined throughout by a thin fibro-serous membrane, the free surface of which secretes a lympid fluid, perily or liquor Cotunnii, in which fluid floats a closed membranous sac, the membranous labyrinth, which l is very similar in shape to, but is smaller than, the osseous vestibule and semi-circular canals, and whi itself filled with a serous lympid fluid, endolymph. Some minute structures recently discovered in the coc also form part of the labyrinth.

Osseous Labyrinth

Consists of the vestibule, the semi-circular canals, and the cochlea.

Vestibule

Is the central cavity of the labyrinth. It is situated on the inner side of the tympanum. It comm cates, in front, by a large opening, with the scala vestibuli of the cochlea, and behind, by openings, with the semi-circular canals.

On its *outer, or tympanic wall,* is the fenestra ovalis, which is closed by the base of the stapes and its ann ligt., by which fenestra the cavity of the vestibule communicates with that of the tympanum.

Its *inner wall* presents in front a small circular depression, the fovea hemispherica, which corresponds to saccule, and at the lower part of which several minute foramina, forming the macula cribrosa, are see give passage to the filaments of the saccular branch of the vestibular nerve; behind the fovea, bounding it posteriorly, is a vertical ridge, the crysta or pyramidal eminence. Behind this is the ope of the aqueductus vestibuli.

On its *roof,* above and behind the fovea hemispherica, and separated from it by the pyramidal eminenc the fovea semi-elliptica, a small transversely oval depression, which corresponds to the utricule, and pres another similar macula cribrosa for the passage of the utricular and ampullar branches of the vestib nerve.

Semicircular Canals

Are situated behind and a little above the vestibule. They are three in number, and are termed respecti superior, posterior, external. Each one is at right angles with the two others.

The superior and the posterior are vertical. The former is placed at right angles with, the latter is parallel the posterior surface of the petrous bone. They both present a dilatation, or ampulla, the former at outer, the latter at its inferior, extremity. They join at their opposite extremities, which open by a c mon orifice at the posterior and inner part of the vestibule.

The external semi-circular canal is horizontal, and directed outwards and backwards. It is ampullated at outer extremity.

Cochlea

Is situated in front of the vestibule. In shape it resembles a snail shell.

Its base is directed inwards, and corresponds to the anterior of the two depressions at the bottom of internal auditory meatus. It is perforated by numerous small openings for the passage of the filam of the cochlear branch of the auditory nerve.

Its apex is directed forwards and outwards.

The cochlea presents for examination the modiolus or columella, the spiral canal, and the lamina spiralis.

The Modiolus—is the central axis of the cochlea. It is conical in shape. Its base corresponds to the bas the cochlea, and presents the apertures above-mentioned. Its apex is situated within the last coil an the apex of the cochlea, and it is expanded into a semi-funnel-shaped lamella, the infundibulum, w blends externally with the parietes of the cupola. Its outer surface forms the inner wall of the sp canal. Its centre is channelled by the tubulus centralis modioli, and by numerous smaller canals the passage of small arteries and of the filaments of the cochlear nerve.

The Spiral Canal—takes two turns and a half. It diminishes in size as it approaches the apex of cochlea, and terminates in a closed extremity, the cupola. It has been described till lately as b divided by the lamina spiralis into two scalæ, the scala tympani and the scala vestibuli, the for of which is turned towards the base, and the latter towards the apex of the cochlea.

The Lamina Spiralis—Winds spirally round the modiolus. It presents an osseous part or osseous z broad at the base of the cochlea, much narrower at the apex, which zone extends from the modiolus al half way across the spiral canal, and is continued to the opposite wall by a membranous port or membranous zone. The osseous zone consists of two thin lamellæ of bone, between which numerous minute canals for the passage of the filaments of the cochlear nerve. For the membra zone see minute structures of cochlea.

The scala tympani is closed below by the membrane of the fenestra rotunda, and communicates with the a duct of the cochlea. The scala vestibuli communicates with the vestibule. The two scalæ communi with each other at the apex of the cochlea by a common opening, the "helicotrema."

THE MEMBRANOUS LABYRINTH

Is a closed sac corresponding in shape to, but smaller than, the osseous vestibule and semicircular canals, in which it is contained. It floats in the perilymph, contains the endolymph, and supports the terminal ramifications of the vestibular branch of the auditory nerve, by which it is held in position. The canalis cochleæ of Reissner (see minute structures of the cochlea) communicates with the saccule, and is now described as a part of the membranous labyrinth.

Vestibular Portion

Consists of two sacs, the utricule and the saccule, which are generally believed to have no communication with each other.

The Utricule is the largest. It is transversely oval, and is situated behind the saccule, opposite the fovea semi-elliptica, at the upper and back part of the osseous vestibule. It communicates behind by five openings with the membranous semicircular canals.

The Saccule is the smallest. It is globular, and is situated a little below, and in front of the utricule in the fovea hemispherica close to the opening of the scala vestibuli of the cochlea.

Membranous Semicircular Canals

Are similar to the osseous semicircular canals in number, form and situation, but are only about one-third their diameter. They open into the utricule by five orifices.

The membranous labyrinth is semi-transparent, and is usually described according to Kölliker as being formed of three layers; the outer layer containing the blood vessels, the terminal ramifications of the vestibular nerve and pigment cells, and being very similar to the outer layer or lamina fusca of the choroid; the middle layer being transparent and similar to the hyaloid membrane of the eye, but being slightly striated; the inner layer consisting of polygonal nucleated epithelial cells. Both Hirschfeld and Sappey, however, recognise only an outer layer of connective tissue containing vessels and nerves and a few pigment cells, and an inner layer of pavement epithelium.—The walls of the utricule and saccule are thickest at the points where the filaments of the vestibular nerve, are distributed to them, and they present at those points two small collections of a pulverulent calcareous material, the otoconia, formed of minute crystalline grains of carbonate of lime (Breschet). It is only in the lower vertebrata that the otoconia is collected into two hard masses or "otoliths" (Breschet, Sappey). A similar calcareous material exists in the cells lining the ampullæ of the semicircular canals. (Bowman).

The Auditory Nerve

Divides in the internal auditory meatus into two branches, the vestibular and the cochlear nerves.

Vestibular Nerve

Divides into three branches, the divisions of which branches pass through the small openings at the upper and back part of the cul-de-sac at the bottom of the internal auditory meatus, and are distributed to the utricule, the saccule, and the ampullæ opposite the masses of otoconia.

Cochlear Nerve

Divides into numerous filaments, which pass through the small openings at the base of the modiolus, and through the minute canals in its axis. These filaments bend outwards between the plates of the lamina spiralis, forming a plexus, in which ganglion-cells are found; branches from this plexus perforate the lower edge of the osseous zone of the lamina spiralis, (habenula perforata) and form radiating bundles comprised partly within the osseous and partly within the membranous zone; the terminal filaments of the cochlear nerve are believed to be connected with the spindle-shaped cells of the organ of Corti. (Kölliker).

The Arteries of the Labyrinth

Are first the internal auditory artery, a branch of the basilar artery or of the superior cerebellar, which artery presents a similar distribution to that of the auditory nerve, secondly branches from the stylo-mastoid artery. They form a minute capillary network on the walls of both the osseous and the membranous labyrinth.

The veins accompany the arteries.

A.

THE MINUTE STRUCTURES of the COCHLEA

Were described by Reissner and by Corti in 1851, but they remained nearly unknown up to a comparatively recent date.

The membranous zone of the lamina spiralis is now known to be composed of two membranes, the membrana basilaris or basilar membrane, which bounds the scala tympani, and the membrane of Corti.

The membrane of Corti, membrana tectoria, arises from the inner part of the limbus laminæ spiralis or denticulate lamina of Todd and Bowman, which latter is a thick periosteal development, which covers the upper or vestibular surface of the osseous portion of the lamina spiralis in its outer fifth, and which presents numerous tooth-like processes. Between the denticulate lamina and the margin of the underlying bone is a groove, the sulcus spiralis, the lower edge of which it is that gives attachment to the basilar membrane. Both the Basilar membrane and the membrane of Corti are attached close together to the outer wall of the spiral canal, the ligamentum spirale (which is perhaps muscular in structure, Todd and Bowman) serving for the attachment of the former. Between the basilar membrane and the membrane of Corti is comprised a narrow canal, the scala media (Kölliker).

Another membranous partition, the membrane of Reissner, arising from the inner part of the limbus laminæ spiralis becomes also attached to the outer wall of the spiral canal, and cuts off from the scala vestibuli a three-sided prismatic canal, the canalis cochleæ.

The canalis cochleæ passes upwards into the cupola, where it ends in a blind pointed extremity, and downwards to near the vestibule, where it ends in the same manner ; a small duct, the canalis reuniens (Hensen) joins its vestibular end to the saccule, and renders its cavity continuous with that of the latter.

The scala media contains the organ of Corti. This latter consists of rods and elongated cells which stand on the membrana basilaris on each side of an intervening space. The rods are arranged in two rows. They incline towards each other, and meet like the beams of a roof over the intervening space. Where they meet they are flattened, and form quadrilateral plates, which are directed outwards, those of the inner row overlying those of the outer, and both together presenting an appearance similar to that of the rows of keys of a piano.

The cells are arranged vertically, or in a slightly oblique direction, on each side of the rods, and have stiff cilia projecting from their upper extremity. The inner set of cells, cells of Claudius, form a single line. Those of the outer set, pedunculated cells of Corti, are three deep ; a few spindle-shaped cells, cells of Deiters, are interposed between the latter.

A very delicate membrane, the membrana reticularis (Kölliker), mainly formed of squamous epithelial cells, extends from the line of contact of the rods to the outer wall of the cochlear tube. It is perforated by the cilia of the cells of Corti. Its use is supposed to be to keep the cells and rods in their places.

The remaining part of the basilar membrane is covered with hexagonal epithelial cells. Large epithelial cells also fill the sulcus spiralis.

The free edge of the osseous zone is perforated, just above the attachment of the basilar membrane, by numerous small apertures for the passage of the radiating branches of the cochlear nerve, and is termed the habenula perforata. The terminal filaments of the nerves are probably connected with the spindle-shaped cells of the organ of Corti.

APPENDIX

TO THE

ORGANS OF THE SENSES.

The Olfactory Cells of Schultze.

Two kinds of epithelial structures are found in the olfactory region, columnar cells & spindle-shaped cells. The latter consist of a large clear nucleus surrounded by only a small amount of granular protoplasm, and they are by far the more numerous.

The deep ends of the *columnar cells* taper to a point, and are prolonged into processes, which branch, anastomose with each other, and form a plexus in the deeper strata of the epithelium.

The *spindle-shaped cells* are grouped round the tapering ends of the columnar cells, and amongst their anastomosing processes. They give off two processes, a superficial one & a deep one. The superficial processes are cylindrical or very slightly tapering; they pass up to the free surface between the columnar cells, and are now stated to terminate abruptly, in man & mammals, at the same level as these.* The deep processes are less regular, more delicate, & varicose.

Statements differ with respect to the connexions with nerves of the deep processes of the structures just described. According to Exner, the deep processes of both structures join in one & the same plexus, the fibres of which are continuous with nerve-fibrils. According to Schultze, it is the deep processes of the spindle-shaped cells only that are continued into nerve-fibres. Mr. Newell Martin upholds the views of Schultze.

* In birds, amphibia & reptiles, the superficial processes of the spindle-shaped cells are prolonged into fine bristles.

Tenon's Capsule, or Tunica Vaginalis Oculi.

The old description of Tenon's capsule has recently been revived in a modified form by Schwalbe and by the Editors of the 8th Edition of "Quain's Anatomy": – This capsule would consist of two membranous layers lined with flattened epithelioid cells; and these layers would enclose a lymph-space which would communicate with the lymph-space between the sclerotic & choroid. This capsule separates the eyeball from the fat of the orbit, and enables it to glide freely on the surrounding structures. The tendons of the recti & obliqui muscles perforate the capsule in front, to reach the sclerotic.

THE STRUCTURE of the CORNEA.

According to the careful description of Rollet, which is endorsed by Profs. Sharpey & Schäfer, what has hitherto been known as the *anterior elastic lamina of Bowman* is no longer to be described separately: This stratum does not differ materially from the remainder of the cornea proper, as will presently be shown. Counting from the surface towards the deeper parts, the layers of the cornea are therefore as follows: – *Anterior layer of epithelium, cornea proper, posterior elastic lamina, posterior layer of epithelium,* or *endothelium,* as Rollet calls it. – The new discoveries in connection with these layers may be summarised as follows: –

Anterior layer of Epithelium – Is of the stratified variety. The *deepest cells* are columnar in shape. Their base, which rests upon the cornea proper, is flattened; and, when seen in profile, it presents a highly refractile line, the *basal hem* or *border.* Their apex is rounded, and capped by one or more of the cells of the layer above. *Above these columnar cells,* are two or three layers of rounded or polygonal cells, with more or less marked angular projections or ribs, separated by intervening furrows. Some of these cells, the *fingered or digitate cells* of Prof. Cleland, send elongated processes between the columnar cells below. *Quite superficially,* there are three or four layers of flattened cells, most of which have retained their nucleus.

Cornea Proper – The fibres of the several inter-communicating strata described by Bowman appear to cross each other at right angles. They are collected into small bundles separated by the matrix or ground substance, which latter is especially abundant between the strata. It is between these strata that the *corneal corpuscles,* the *corneal cell-spaces,* and the canals of *Recklinghausen* are found.

The *corneal corpuscles* correspond to the corpuscles of other connective tissues. They are large branching cells, the processes of which join with those of their neighbours, both of the same & of adjoining strata. They are flattened from above downwards, and expanded laterally: in vertical sections they appear as fusiform swellings; it is only in horizontal sections that their true form & relations are seen. Their protoplasm is clear & hyaline, except near the nucleus, where it is more or less granular.

These corpuscles lie in the *corneal cell-spaces,* which, though being a little larger than the contained corpuscles, correspond to them in figure; and give off anastomosing tubular offsets, which ensheathe the processes of the cells.

The system of these cell-spaces & tubules forms what are called *Recklinghausen's canals.* These are continued into the cell-spaces of the sclerotic, and serve for the passage of lymph & leucocytes. They can easily be injected by introducing the nozzle of a small syringe into the corneal tissue, using a thin fluid, and employing a low pressure: a network of stellate anastomosing figures then immediately appear. If too consistent a fluid be used, or too great force employed, the injection matter becomes extravasated between the bundles of fibres of the corneal tissue; and the appearance produced is that of minute varicose canals running at right angles to one another in the several strata.

The so-called Anterior Elastic Lamina of Bowman is simply a layer of corneal tissue slightly condensed, free from corpuscles & cell-spaces, and in which a few oblique fibres, the *binding fibres, or fibræ arcuatæ of Stutzfasern,* are seen to pass towards the surface.

The Posterior Elastic Lamina, or Membrane of descemet or demours, is perfectly transparent & apparently structureless; firm & elastic, but very brittle; unaffected by acids, alkalies, or boiling water. It is covered posteriorly with a single layer of flattened polygonal nucleated cells (V. page 356).

The Nerves of the cornea have been carefully studied of late by Cohnheim, Rollet, Klein & others. They are derived from the ciliary nerves, and are from forty to fifty in number. They at first retain their dark outline, but soon become transparent. They then ramify, and form a relatively coarse *primary plexus* throughout the laminated structure. From this primary plexus, two sets of branches are given off, those which supply the cornea proper and those which supply the anterior epithelial layer. The fibres which supply the cornea proper form a *secondary plexus,* much finer & closer than the primary one above described, but the cords of which still consist of several nerve-fibres. From this secondary plexus, arises a terminal or *tertiary plexus* of ultimate fibrils. The fibres which supply the epithelium similarly form a fine *secondary* or *sub-epithelial plexus* close to the anterior surface of the cornea proper. From this plexus, a tertiary or *intra-epithelial plexus,* finer still, extends almost to the free surface. – A few nuclei are found at the points of junction of the larger cords of the primary plexus; they appear, however, not to be nerve-cells lying in the course of the nerve-fibres, but rather to belong to the ensheathing cells described below.

No proper Lymphatics appear to exist in the cornea. Tubular sheaths of flattened epithelioid cells, apparently in continuity with the canals of Recklinghausen, surround, however, the larger branches of the nerves, and ramify with them.

THE MIDDLE TUNIC of the EYE.

Choroid.

The first point of interest in connexion with the choroid is that it is to be described, no longer as a *vascular & pigmentary* membrane, but simply as a *vascular* membrane: – What was formerly known as its *pigmentary layer* is now considered *a part of the retina.* The reason of this is that the pigmentary layer is developed, in common with the retina, from the primary optic vesicle, *i. e.*, from the anterior cerebral vesicle, *i. e.*, from the epiblast; while the vascular layer is developed from the mesoblast, in common with the sclerotic, the cornea proper, the muscles, vessels, & nerves (except the optic), etc. There are, however, a good many stellate pigment cells in the outer part of the stroma of the choroid.

Lymph-Space between the Sclerotic & the Choroid: Lamina Fusca, Lamina Supra-Choroidea.

A large lymph-space is described by Schwalbe as extending between the sclerotic & the choroid throughout the whole extent of these membranes. In birds, this space is bounded by two smooth walls, and it resembles a serous sac. But in most animals, it is traversed by numerous trabeculæ; and, in man, these trabeculæ are so numerous that they form quite a plexiform tissue. That portion of this plexiform tissue, which, after detachment of the sclerotic from the choroid, remains adherent to the sclerotic, is what is called the *lamina fusca;* that portion which remains adherent to the choroid, is what is called the *lamina supra-choroidea.*

Ciliary Muscle.

The circular fibres, which lie beneath the radiating ones, and which form what is frequently called the *circular ciliary muscle of Müller*, appear to be greatly developed in hypermetropic eyes, and only slightly developed in, or even entirely absent from, myoptic eyes (Iwanoff). The significance of this fact does not seem as yet to be very clearly made out.

It would appear that some of the radiating bundles of the ciliary muscle are occasionally inserted into the sclerotic (Waldeyer).

Structure of the Iris.

The main points of interest made out by Iwanoff are to the following effect: –

The *posterior epithelial layer of the cornea* is certainly prolonged over the anterior surface of the iris, but with this modification, however, namely, that the cells become smaller and more granular than they are over the membrane of Descemet or Demours.

Both the *sphincter* & the *dilator muscles* lie in the substance of the iris nearer to its posterior than to its anterior surface. The *sphincter* is about a millimetre wide, and it surrounds the pupillary margin. Near this margin it is thin, its fibres are closely packed, and they form complete circles. More externally, the fibres are more distant from each other, the circles they form are less complete, and the muscle is thicker.

The radiating fibres of the *dilator muscle* form either a thin continuous layer, or a network of inter-communicating bundles, pervading the whole structure of the iris from its ciliary to its pupillary margin. Near the pupil, these fibres blend with those of the sphincter in the following manner: some arch round, take a circular direction, and come to form part of the sphincter; others continue in their primitive direction, and, crossing the fibres of the sphincter, run inwards till they reach the pupillary margin. Near the outer, or ciliary margin of the iris, the dilator muscle breaks up into separate fasciculi, which are arranged in two layers lying one upon the other. The fibres then curve round, become circular in direction, and form a kind of annular muscular plexus.

Ligamentum Pectinatum; Canals of Fontana & Schlemm, and Cavernous Spaces communicating with the Anterior Chamber.

The festoon-like processes of white and yellow elastic fibrous tissues surrounded by epithelium, which curve inwards from the membrane of Descemet or Demours towards the periphery of the iris, leave intervals between them, which lead more or less directly into a series of cavernous spaces situated at, or close to, the point of junction of the cornea, sclerotic, iris, ciliary muscle, & ligamentatum pectinatum. These spaces have given rise to much discussion. Some of them appear to be directly continuous with, and to serve for the passage of lymph into, the anterior chamber of the eye; and the canal known in many animals as the *canal of Fontana* would simply be the largest of these cavernous lymphatic spaces (Schwalbe). Even the *sinus circularis iridis, or canal of Schlemm*, which is evidently a circular vein*, is said to be in more or less direct communication with the anterior chamber: – Both the cavernous spaces, and the veins of the anterior part of eye, become filled, it is said, with any coloured fluid injected into the anterior chamber. The reason why the blood does not find its way into the anterior chamber, is probably that greater resistance is offered to its passage in this direction than to its return by the ordinary venous paths.

The statement respecting the Sinus circularis iridis is, however, denied by Leber, who says that it is only a *diffusible* colouring matter, that can penetrate into the veins, when injected into the anterior chamber.

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* Or rather, perhaps, a plexiform system of veins united at intervals into one trunk.

THE STRUCTURE of the RETINA.

The Retina should now be described as a nervous *and pigmentary* membrane.

It is divisible into *eight layers;* and the way in which eight layers are now counted, instead of the three hitherto recognised, is as follows: – On the outer aspect of the retina is first counted, as an additional layer, what used to be called the pigmentary layer of the choroid. Then what used to be called the "Middle or Granular Layer," instead of being divided into three strata, is now divided into four strata; and each stratum is counted as a separate layer. Further inwards, the two strata, which used to be called together the "Internal, or Nervous Layer," *i.e.*, the stratum of nerve-cells, and the stratum of nerve-fibres, are also counted now as two separate layers.

It should be added that the *membrana limitans*, which has hitherto been described as covering the inner surface of the retina, is now frequently described as forming one of the layers of this membrane; and that a second membrana limitans is sometimes described on the inner aspect of the layer of the rods and cones; the first membrana limitans is then called the membrana limitans *interna*, and the latter one, the *membrana limitans externa*. This would bring the number of the layers of the retina to *ten*.

Counting from within outwards, the eight layers generally recognised are:–

(1) – *The Layer of Nerve-fibres;*
(2) – *The Layer of Nerve-cells, or Ganglionic Layer;*
(3) – *The Inner Molecular Layer;*
(4) – *The Inner Nuclear Layer;*
(5) – *The Outer Molecular Layer;*
(6) – *The Outer Nuclear Layer;*
(7) – *The Columnar or Bacillary Layer, or Layer of the Rods & Cones;*
(8) – *The Pigmentary Layer.*

Schultze's View of the Nature & Connections of the Several Layers.

This view, whether absolutely correct or not, has at least the advantage of facilitating the comprehension of the facts, by binding them together into one general conception: It is given here as an *introduction* to the following & more precise histological description, by which it will have here & there to be corrected. This view may be summarised as follows: –

"The Retina is the membranous expansion of the optic nerve."

"Its principal elements are: –

(1) – *Nerve-fibres*, in the course of which are found
(2) – *Ordinary nerve-cells*, bipolar or multipolar, and also
(3) – *Variously modified nerve-cells*, the so-called *Internal & External Granules.* The nerve-fibres break up into exceedingly delicate plexuses in two situations, namely, in the inner & the outer molecular layers; they end in
(4) – *Peculiar terminal organs*, the *Rods & Cones.*"

"Its subordinate elements are: –

(1) – *A modified connective tissue* (spongy connective tissue of Schultze).
(2) – *A layer of pigment-cells;*
(3) – *Blood-vessels;*
(4) – *Lymphatics.*"

"The connexions of the principal, or nervous elements, are as follows": –

"The non-medullated fibres of the first or Nerve-fibre Layer are continued into the proximal offsets of the nerve-cells of the second or Ganglionic Layer."

"The distal offsets of these nerve-cells, which are somewhat thicker than the proximal ones, enter the Inner Molecular Layer, where they break up into a first and exceedingly fine plexus of primitive nerve-fibrils."

"In the next layer, or Inner Nuclear Layer, we see these nerve-fibrils (1) taking a more or less vertical course, either singly or in very fine bundles; (2) passing through modified bipolar nerve-cells, the *inner granules* (of which there is but one for each fibril or bundle of fibrils); and (3) becoming collected into relatively large bundles, which enter the following, or outer molecular layer."

"In the Outer Molecular Layer, we find the relatively large bundles above mentioned breaking up into a second exceedingly fine plexus similar to the one already described as existing in the inner molecular layer."

"In the next layer, or Outer Nuclear Layer, we found an arrangement very similar to the one which prevails in the inner nuclear layer: – The nerve-fibrils are again collected into bundles, some relatively thick (cone-fibres), others much thinner (rod-fibres); all relatively thick, however, as compared with the bundles, or separate fibrils, which traverse the inner nuclear layer. Like these latter bundles, or separate fibrils, the bundles of the outer nuclear layer (1) take a more or less vertical course, (2) pass through a second set of modified bipolar nerve-cells, the *outer granules* (of which also there is but one for each bundle of fibrils), and (3) become collected into relatively thick bundles (upper part of the cone- and rod-fibres)."

"Finally, in the Columnar or Bacillary Layer, or Layer of the Rods & Cones, we see the relatively thick bundles last named expanding into the lower, homogeneous, or slightly granular, basal portion of the rods & cones."

SEPARATE DESCRIPTION of the EIGHT LAYERS.

Layer of Nerve-Fibres.

Is the direct continuation of the optic nerve. At its point of entrance into the eye, the optic nerve pierces the sclerotic & choroid, and all the layers of the retina, except this layer of nerve-fibres, which it forms by its expansion. Its fibres then radiate from the colliculus to the ora serrata, forming delicate inter-communicating bundles supported by a few flattened connective tissue corpuscles. These fibres consist of axis-cylinders only, without either primitive or medullary sheaths; they vary a good deal in size, and are wanting at the yellow spot.

Ganglionic Layer, or Layer of Nerve-Cells.

Consists, over the greater part of its extent, of a single stratum of nerve-cells, bipolar or multipolar. Over the yellow spot (the fovea excepted), & in its neighbourhood, the cells are more thickly set (sometimes they are eight or ten deep), but they are smaller. Towards the ora serrata, they form but an incomplete layer.

These cells present one delicate unbranched internal process, and one or more external processes, a good deal thicker, and branched. The internal process arises from the inner extremity of the cell, which is always more or less rounded, and it passes obliquely into the layer of the nerve-fibres, with one of the fibres of which it probably becomes continuous. The origin of the external branched process, or processes, is from the outer and usually tapering end of the cell; these processes pass up into the inner molecular layer.

Inner Molecular Layer.

Is a comparatively thick stratum of granular looking substance, respecting the nature of which, we quote from Max Schultze's masterly article on the Retina in Stricker's Handbook of Histology.

"The peculiar appearance of the inner molecular layer is due to the admixture of a very fine plexus of spongy connective tissue, given off from the radial supporting fibres (fibres of Müller), with immeasurably minute nerve-fibrils. The latter form an essential constituent of this layer. They may be isolated for short distances, when they appear as extremely delicate & very tortuous fibres beset with fusiform varicosities. The thicker and branched ganglion-cell processes, which dip into this layer, can be still more distinctly followed, though little is known in respect of their mode of termination. It is doubtful whether, besides the nerve-fibres & the plexuses of the connective substance, a certain number of minute granules of unknown nature are not also present, as *appears* to be the case; or whether the nerve-fibres and the spongy connective substance give rise by their peculiar disposition to the finely granular appearance. In regard to the course and ultimate destiny of the processes of the ganglion cells and fine nerve-fibres of this layer, we must admit the impossibility of giving any positive statement: The internal molecular layer interrupts our knowledge of the course of the nerve-fibres, which again become visible in the outer layers of the retina."

N.B. – It is but right to state that Schwalbe is of opinion that the Müllerian fibres, not only traverse the inner molecular layer without giving off any offsets to it, but are of a quite different chemical composition.

Inner Nuclear Layer.

Is composed of several strata of transparent nucleus-like bodies known as "inner granules." These are of three different kinds.

The more numerous ones are regarded as bipolar nerve-cells with a large nucleus & but a relatively small amount of protoplasm, – the latter being collected mainly at the inner and outer ends of the cell, and prolonged into two delicate processes, an inner one & an outer one. The inner processes are the finer and usually the longer; they are unbranched, and they exhibit minute varicosities similar to those observed on ultimate nerve-fibrils; they are clearly seen to dip down into the inner molecular layer; and it is more than likely that some of them become continuous with the outer branched processes of the nerve-cells, while others are probably continued into some of the fibres of the optic nerve. The outer processes are thicker, branched, non-varicose, and usually shorter. They dip into the outer molecular layer, and break up into branches usually two in number. These pass off nearly at right angles; and break up into a plexus of exquisitely fine fibrils.

The two other kinds of "inner granules" are first a few nucleated bodies connected with the fibres of Müller (V. fibres of Müller); and then some large rounded cells accumulated, some in the inner, others in the outer strata of this layer, and either not prolonged into any process, or prolonged into one process only.

Outer Molecular Layer.

Is a thin granular stratum very similar in appearance to the inner molecular layer. Three kinds of elements are made out, at least in the horse, as entering into its structure. There is a close network of exceedingly fine connective tissue fibrils similar to those which enter into the structure of the inner molecular layer; there are the branched & granular cells, each with a large clear nucleolated nucleus, from which the above fibres are derived; and, finally, there are fine varicose nerve-fibrils probably derived from the outer prolongations of the bipolar nerve-cells of the inner nuclear layer.

Outer Nuclear Layer.

Consists of vertical fibres, or bundles of fibres, which traverse its entire thickness, and in the course of each of which is found an oval nucleated body termed an "outer granule." Both fibres & granules are of two kinds. There are the rod- & the cone-fibres, which are continuous superiorly, the former with the rods, the latter with the cones of the columnar layer; and the rod- & the cone-granules, situated, the former in the course of the rod-fibres, the latter in the course of the cone-fibres.

As, in the greater part of the columnar layer, the rods are much more numerous than the cones, so, in the greater part of the outer nuclear layer, are the *rod-fibres* much more numerous than the cone-fibres. They are also much more delicate, and marked by minute varicosities, which the cone-fibres do not present. Internally, they appear to terminate upon the outer molecular layer in a varicosity somewhat larger than the others, and from which exquisitely fine fibrils radiate into this outer molecular layer.

The *cone-fibres* are much thicker, and less numerous. They are continuous externally with the pear-shaped enlargement of a cone. They terminate internally in a large expanded & pyramidal extremity, or base, which rests upon the outer molecular layer, and from which exquisitely fine fibrils radiate into the substance of this layer. While the rod-fibres are apparently structureless, a delicate striation, or fibrillation, is sometimes visible on the cone-fibres.

The *rod-granules* are ovoid enlargements which may be situated in any part of the course of the rod-fibres. They are occupied by a very large nucleus devoid of nucleolus, but which exhibits a remarkable cross-striped appearance: – The highly refracting substance of this nucleus is divided into three relatively dark transverse bands by two clearer & less refracting ones; sometimes there are but two dark bands & one clearer one.

The *cone-granules* are pyriform enlargements usually situated in the upper or peripheral part of the course of the cone-fibres, close to the so-called membrana limitans externa. Their larger end is turned outwards, and is directly continuous with the base of the corresponding cone; or there is at most but a short thick trunk uniting them. Their narrow end is turned inwards, and continued into a cone-fibre. The cone-granules are larger than the rod-granules, but they present no transverse striation.

It should be added that the real difference between the two kinds of granules is probably not so great as would appear at first sight. As regards the transverse striation of the rod-granules, it is considered by Krause to be a post-mortem phenomenon due to the partition of the nucleus. And, as regards the superficial position of the cone-granules in the outer nuclear layer, it may immediately be stated that it does not prevail everywhere: – At the yellow spot, where there are only cones in the columnar layer and only cone-fibres & cone-granules in the outer nuclear layer, and where these structures are therefore more closely packed than elsewhere, the cone-granules are arranged in several strata separated from the bases of the cones by a considerable distance, and connected to them by an attenuated stalk. Both rod-granules & cone-granules are indeed considered by Max Schultze as nerve-cells with a very large nucleus & only a small amount of protoplasm. Similarly also are the rod-fibres considered by this Author to be nerve-fibres, and the cone-fibres to be bundles of the same. The rods & cones of the columnar layer, next to be described, would then be the terminal organs of the optic nerve-fibres.

Columnar or Bacillary Layer, or Layer of the Rods & Cones.

Is probably the layer which contains the terminal organs of the optic nerve-fibres, *i.e.*, the organs in which impressions of light originate through the conversion of luminous vibrations into sensory nerve-movement.

These terminal organs are of two kinds, the *rods* & the *cones*, the general arrangement of which has been given in the old description, page 358.

The rods are much more numerous than the cones, except at the yellow spot, where only cones are found.

Both rods and cones consist of *two very different segments*, an inner one and an outer one; the separation between which segments occurs, in the case of the rods, about the middle of their length, and in the case of the cones, towards the junction of their middle & outer thirds.

In the rods both segments are very nearly of the same size & shape, the inner segment being simply a little bulged towards its middle. In the cones, on the contrary, the inner segment is much wider than the outer one, the latter appearing merely as a pointed appendix to the former; both segments are also shorter, the outer one especially: The cones do not reach the pigmentary layer, while the rods are partly embedded in it.

The *inner segments* of both rods & cones are marked by *two sets of longitudinal striæ*, the *external or superficial*, & the *internal or deep*.

The *external or superficial striæ* are well represented in the figure on page 613 of the Eighth Edition of "Quain's Anatomy." These striæ appear to be due to delicate longitudinal fibres of connective tissue, which, on the one hand, are continued from the connective tissue of the outer molecular layer, and, on the other hand, are prolonged upon the outer segments, giving rise to the superficial striation which these also present (Max Schultze). These fibres form "basket works" or "cradles" for the support of the rods & cones.

The *deep or internal striæ* are well represented in the figure on page 612 of the above-mentioned Edition of "Quain's Anatomy." They are faintly visible also in the figure on page 613, where, in the upper three-fourths of the inner segment of the cone, they are seen to be superadded to the superficial striæ, which alone exist in the lower fourth. This internal striation exists only in the outer part of the inner segment. It ends somewhat abruptly, in the rods at the junction of the middle & outer thirds, in the cones at the junction of the middle & inner thirds.

Thus both rods and cones present an inner or basal portion (inner third of the cones, inner two-thirds of the rods) which presents no deep or internal striation, and is either homogeneous or more or less granular.

Both in the rods and in the cones, this homogeneous basal portion is continuous internally with the corresponding fibre & granule of the outer molecular layer, – with the corresponding rod-fibre & rod-granule in the case of the rods, with the corresponding cone-fibre & cone-granule, in the case of the cones.

The *outer segments* of both rods & cones also present a *double striation:* firstly the *longitudinal striation* above described as being prolonged upon them from the inner segments (which longitudinal striation is less evident, however, on the outer segments of the cones than on the outer segments of the rods); and secondly a well marked *transverse striation* especially evident on the outer segments of the cones. This transverse striation corresponds to the lines of separation of a series of superimposed discs, into which the outer segments have a tendency to break up, especially when dipped into aqueous fluids, or otherwise submitted to the effects of imbibition.

Respecting the nature of the rods and cones, it is suggested by Max Schultze that only the inner segments are nervous elements; that the outer ones are mere physical or mechanical appendages comparable to the auditory hairs, the hair-like processes of the olfactory membrane of amphibia, reptiles, etc.; and that the two segments are connected together merely by a common sheath formed by the longitudinal fibres of connective tissue already described. This view is supported by the fact that, while the inner segments are easily stained by carmine, iodine, etc., the outer ones, on the contrary, are scarcely coloured by these reagents.

Pigmentary Layer.

Has been very carefully described by Max Schultze, who has shown that it is intimately blended with the outer part of the layer of the rods & cones. It consists of a single layer of hexagonal nucleated cells. The upper or outer part of these cells—that which is turned towards the choroid—is flattened, devoid of pigment, and usually contains the nucleus. The lower or inner part is loaded with pigment granules, and is prolonged into numerous dependent processes, which partly fill up the intervals between the rods & the tapering ends of the cones. It is these processes, which, in the embryo, obliterate little by little the cavity of the primary optic vesicle by joining its two walls into one membrane.

SCARPA'S TRIANGLE – 1st Tablet.

Is a broad triangular depression
- *Situated* at upper, inner, & front part of thigh;
- *Bounded* by Poupart's ligament, sartorius & adductor longus;
- *Continued downwards & inwards* into a superficial furrow, which **marks position of femoral artery in Hunter's canal.**

Its floor is formed from without inwards by iliacus, psoas, pectineus, & small **part of adductor brevis.**
It contains femoral vessels & anterior crural nerve, and the

PARTS CONCERNED IN FEMORAL HERNIA — These parts are :-

SKIN — Thin, freely movable, more or less studded with hairs at upper & inner part.

SUPERFICIAL FASCIA — Divided into two layers by superficial vessels & nerves & inguinal lymphatic glands.

- **SUPERFICIAL LAYER** – Thick, areolar, contains a large amount of fat, and is continuous with subcutaneous tissue of surrounding regions; is rather thinner & less loaded with fat towards lower part of triangle.
- **DEEP LAYER** – Thin & membranous. Adherent superiorly to Poupart's ligament. Stretches over saphenous opening under the name of "*cribriform fascia*," which fascia is perforated by internal saphenous vein & by numerous smaller blood & lymphatic vessels, and is attached firmly to outer margin of the opening, & slightly to the inner margin.

Superficial Vessels & Nerves and Lymphatic Glands – Are the :
- *Internal saphenous vein ;*
- *Superficial epigastric, superficial circumflex iliac, superficial external pudic arteries* with the corresponding veins, which latter open into internal saphenous near its termination;
- *Ilio-inguinal, crural branch of genito-crural, & external cutaneous nerves.*
- *Lymphatic glands* – Form two groups. Those of the
  - *Superior or abdominal group* – Are the smaller, and are placed transversely near Poupart's ligament; – they receive lymphatics of penis, scrotum, perinæum, lower part of abdomen & buttock; – those of the
  - *Inferior or femoral group* – Are the larger, and are vertically disposed round upper part of saphenous vein ; – they receive the lymphatics of lower limb.

DEEP FASCIA or FASCIA LATA — Dense, fibrous. Presents the saphenous opening, for easier description of which it is usually divided into two portions, the iliac & the pubic.

- **ILIAC PORTION** – The thicker. Attached to crest of ilium, Poupart's ligament & spine of pubes. Is reflected downwards & outwards from this latter point, first bounding the superior angle, or *superior cornu* of the opening, then forming its outer margin. This outer margin is the *falciform process of Burns ;* its upper part is often called *Hey's femoral ligament.* Superiorly this margin overlies the sheath of the femoral vessels. Inferiorly it becomes continuous with pubic portion of the fascia lata by a well defined curved border, which forms the inferior angle, or *inferior cornu* of the opening.
- **PUBIC PORTION** – Much thinner. Is attached to pubic arch at upper and inner part of thigh, and is continuous with iliac portion opposite lower cornu of saphenous opening. From this point it is prolonged upwards & outwards behind femoral sheath & in front of pectineus, and becomes attached to ilio-pectineal line.

Saphenous Opening – Is formed therefore by the slitting of the fascia lata & by the folding of the two sides of the slit one over the other. It is oval in shape, broad below, narrow above, 1½ inches long, ½ an inch wide. Its

- **OUTER BOUNDARY & ITS SUPERIOR ANGLE OR CORNU,** – Which are prominent & well defined, are formed by iliac portion of the fascia lata (falciform process & femoral ligament), which portion, as already stated, passes upwards & inwards in front of the femoral sheath, and becomes attached to Poupart's ligament & spine of pubes. – Its
- **INNER BOUNDARY** – Depressed & less clearly defined, is formed by the pubic portion of the fascia lata, which portion, as already stated, passes upwards & outwards behind femoral sheath & in front of pectineus, and becomes attached to the ilio-pectineal line. – Its
- **INFERIOR ANGLE OR CORNU** – Is formed by the junction of the iliac & pubic portions of the fascia lata just below opening **of internal saphenous vein into** the femoral.

FEMORAL SHEATH — **Vide next Tablet.**

SCARPA'S TRIANGLE — 2nd Tablet.

FEMORAL SHEATH — Is a thin tube of fascia divided by two delicate septa into three compartments, of which compartments the outermost contains the femoral artery & the crural branch of the genito-crural nerve, the middle one the femoral vein, and the innermost, which is called the femoral canal, some fat & a lymphatic gland.

It is expanded superiorly, where it is continuous beneath Poupart's ligament with the fasciæ of the abdomen, the fascia transversalis & the fascia iliaca passing down to form it, the former in front of, and the latter behind, the femoral vessels.

It is narrow inferiorly, and blenes about two inches below Poupart's ligament with the common areolar sheath of the femoral vessels.

Anteriorly it is covered by the iliac portion of the fascia lata (falciform process & femoral ligament), Poupart's ligament, the deep crural arch, and, opposite the saphenous opening, by the cribriform fascia.

Posteriorly it rests upon the pubic portion of the fascia lata & the pectineus muscle.

Its outer wall is vertical, lies in immediate contact with the artery, and is perforated by the crural branch of the genito-crural nerve.

Its inner wall is oblique downwards & outwards from base of Gimbernat's ligament to inner surface of femoral vein. It is pierced superiorly, where it corresponds to the femoral canal, by numerous lymphatic vessels, and, inferiorly, or below the femoral canal, by the internal saphenous vein.

FEMORAL CANAL — Is the innermost compartment of the femoral sheath. Or rather it is the narrow interval comprised, at the upper part of the femoral sheath, between the inner wall of the sheath & the femoral vein; for it can hardly be said to exist as a distinct canal unless the wall of the sheath has been separated from the vein either by dissection or by the pressure of a hernia. – It contains a little fat & a lymphatic gland.

It extends from the femoral ring to the upper part of saphenous opening, and measures from ¼ to ½ an inch in length.

It presents four walls & two openings.

- ANTERIOR WALL – Formed by the fascia transversalis, and supported by Poupart's ligament, deep crural arch, & iliac portion of fascia lata (falciform process & femoral ligament);
- POSTERIOR WALL – Formed by the fascia iliaca; rests upon pubic portion of fascia lata & pectineus muscle;
- INNER WALL – Formed by junction of fasciæ transversalis & iliaca;
- OUTER WALL – Formed by the thin septum on inner side of femoral vein;
- SUPERIOR OPENING, OR FEMORAL RING – Vide below.
- INFERIOR, OR SAPHENOUS OPENING – Vide foregoing Tablet.

Femoral Ring – Is the opening of the femoral canal into the abdomen. – Its boundaries are:–

- IN FRONT – Poupart's ligament and the deep crural arch;
- BEHIND – Pubes covered by pectineus muscle. & pubic portion of fascia lata;
- INTERNALLY – Gimbernat's ligament with the triangular ligament, the conjoined tendon, & the deep crural arch.
- EXTERNALLY – Femoral vein & the thin septum between it & crural canal.

Its relations are as follows:

- *Femoral vein*, on outer side;
- *Epigastric artery*, crossing upper & outer angle;
- *Spermatic cord or round ligament, & pubic branch of epigastric* above & in front;
- *Obturator artery*, on inner side, in those rare cases in which the artery presents the double abnormality of arising from the epigastric artery, and of arising from that artery at some distance from its root; – the obturator artery then passes first inwards above the ring, and then downwards into the pelvis behind Gimbernat's ligament.

It is nearly circular, about ½ an inch wide in the male, a little wider in the female, and is closed by the

SEPTUM CRURALE (J. Cloquet) – A more or less condensed layer of superitoneal areolar tissue adherent to margins of femoral ring, and perforated by numerous apertures for lymphatics. Its upper surface is concave, and separated from the peritoneum by a less condensed layer of the same tissue and sometimes by a lymphatic gland; its under surface is convex & turned towards the femoral canal.

The femoral canal & both its openings are constricted by extension & eversion, and relaxed by flexion & inversion of the thigh.

COVERINGS OF FEMORAL HERNIA — Are :–

FROM WITHIN OUTWARDS : – *Peritoneum, subperitoneal areolar tissue* (a portion of which, thickened & caused to assume a membranous appearance by the pressure of the hernia, was described by Sir A. Cooper under the name of *fascia propria*), *septum crurale, crural sheath, cribriform fascia, superficial fascia, skin.*

FROM WITHIN OUTWARDS : – *Skin, superficial fascia, cribriform fascia, crural sheath, septum crurale, subperitoneal areolar tissue, peritoneum.*

The deep seated stricture is to be divided upwards & inwards, in which direction no important vessel is likely to be met with.

Peculiarities of Structure towards the Ora Serrata, & in the Pars Ciliaris.

Towards the ora, these peculiarities are—(1) the gradual thinning of the retina as a whol (2) the gradual disappearance of the principal or nervous elements, and (3) the relative increa of the connective tissue elements, & more particularly of the fibres of Müller. Then come *at the ora,* a somewhat abrupt change, which takes place in a zone of about $\frac{1}{250}$ of an inch i breadth. All the structures of the retina (except the pigmentary layer, which is continued upo the ciliary processes), are replaced by the single layer of cells of the *pars ciliaris.*

The layer of the rods & cones disappears first, the cones extending a little further tha the rods. The nerve-fibres & nerve-cells disappear next. The inner molecular layer continue a little further, but it is made up to a great extent of Müllerian fibres; it ends in a some what rounded margin. Further on, the two nuclear layers merge into one layer, which become continuous with the layer of cells of the pars ciliaris.

The *pars ciliaris* consists of a single layer of cells—columnar, striated, or finely granula with a clear oval nucleus in their outer part, near the pigmentary layer. These cells are a first of a considerable height, but they soon become much shorter. What their real nature is, i a question which has given rise to much discussion. By Kölliker they are considered to correspond to the larger cells which form the bases or feet of the Müllerian fibres, and which giv rise, by their union with each other, to the membrana limitans interna. Schultze inclines i favour of this view. Schwalbe, on the contrary, opposes it on the strength of his belief tha the membrana limitans interna is not formed by any part of the Müllerian fibres, and that i is further prolonged upon the pars ciliaris. The inner end of these cells varies a good dea in shape; it may be rounded, pointed, square, branched, etc. Their sides are sometimes prolonged into processes, from which delicate fibres are given off.

THE STRUCTURE of the LENS.

The drawings of Babuchin & Arnold, reproduced on pages 625, 764 & 765 of the Eighth Edition of "Quain's Anatomy," will facilitate the comprehension of the following additional details from Prof. Babuchin's article on the lens in Stricker's Handbook of Histology, from which article our most recent information on the subject is to a great extent derived.

The lens may be regarded as consisting of a thin anterior wall composed of a single layer of cells, and of a thick posterior wall composed of cells elongated into fibres, between which walls is comprised a cavity, real in the fœtus, virtual in the adult.

Both cells & fibres are perfectly transparent, in fact invisible, when fresh, but after a time, or after treatment by reagents, they become cloudy, and they then show their contour & their nucleus.

The central cells of the anterior wall are flattened; the peripheral ones become cubical, or elongated perpendicularly to the surface. Farther outwards the cells become still taller, and also oblique & conical, their inner ends inclining forwards towards the anterior surface of the lens, and their broad bases being turned backwards towards the posterior surface. Still farther outwards the cells become longer still, and their direction still more oblique, their anterior extremities curving farther & farther forwards to meet more & more central cells of the anterior surface.

Thus the transition from the cells of the anterior wall to the fibres of which the posterior wall is composed, is effected by the simple elongation of the former.

The mode of formation of the posterior wall is as follows: – Flattened fibres unite to form lamellæ, which, covering one another concentrically like the coats of an onion, first increase in size from the point of transition between the walls towards the axis of the lens, and then diminish towards the central part or nucleus, attaining their smallest diameter at, or a little behind, the centre of the organ.

The peripheral or equatorial, or transitional, lamellæ are curved outwards, that is to say, they present their convexity towards the axis of the lens. They are slender in the centre & expanded at their extremities, these extremities resting, the anterior one on the flattened cells of the anterior wall of the lense-cavity, the posterior one on the posterior lamella of the capsule.

As we pass from the periphery of the lens towards its axis, we find the several lamellæ first becoming straight, and then curving inwards, and at the same time becoming longer: – Each successive lamella projects beyond the superjacent ones, and, both in front & behind, the lamellæ overlap each other like the tiles of a roof.

All the lamellæ above described extend from the cells on the anterior aspect of the lens, in front, to the posterior lamella of the capsule, behind. Beneath them, *i.e.*, nearer the nucleus, is, however, a more central set of lamellæ, whose anterior and posterior extremities terminate within the lens in a more or less complex manner. In some fishes & amphibia, these latter lamellæ meet in the axis of the lens, both in front & behind. In the torpedo, the posterior extremities meet in the axis, while the anterior ones form a raphé, which appears in the shape of a transverse line. In some mammals, such as the rabbit, the hare, etc., both the anterior & the posterior extremities of the lamellæ terminate as above, the anterior & posterior raphés, however, crossing each other at right angles. In the human fœtus, the anterior and posterior raphés become stars with three rays, usually described (V. page 359) as the "planes of separation" between the "segments." In the adult, the rays multiply, and the stars become more complex. – As to the course of the individual fibres of the "segments," the statements on page 359 are confirmed.

The lense-fibres are more or less flattened six-sided prisms with slightly serrated edges. They fit so exactly one to the other, that, except in the planes of separation between the segments, where the *extremities* of the fibres meet, there is but little cementing substance between them.

In the early condition, each fibre presents an oval nucleus which is first situated a little behind, and then, as the fibre elongates, a little in front of the middle of its length. In the adult, these nuclei disappear, except towards the periphery of the lens, where they remain to form the *nuclear zone*, or, as it is sometimes called, *Meyer's zone*.

The lense-fibres have probably no distinct limiting membrane or sheath, though their outer parts are denser and less easily acted upon by reagents than the more central ones. This is also the case with the more central parts of the length of the fibres as compared with their extremities.

In the adult, the lens & its capsule receive no vessels: – The *capsulo-pupillary membrane*, and the branch of the arteria centralis retinæ which reaches it through the canal of Stilling, disappear a little before birth, *i.e.*, as soon as the aqueous chamber begins to expand.

The capsule of the lens is apparently structureless. It is thinnest opposite the posterior pole, and thickest where it blends with the suspensory ligament or zonula of Zinn.

For further details the reader is referred to "Quain's Anatomy," and to the translation of Prof. Babuchin's article by Mr. Henry Power.

THE VITREOUS BODY.

Although, in the fresh condition, the vitreous body appears structureless, or very ne so, in hardened preparations a more or less distinct concentric lamellation can be perceive the portion nearest the retina, which portion is also firmer than the more central part. from this appearance it is conjectured that the peripheral portion of the vitreous body is divi by exceedingly delicate membranes into flattened lamellæ parallel to the surface, and inclu one within the other. A radial marking has also been observed in sections made transversel the axis of the eyeball.

Scattered throughout the vitreous body are a variable number of corpuscles. Some off processes presenting bud-like enlargements like strings of pearls; others contain la vacuoles by which their nucleus is pushed to one side; many are apparently white bl corpuscles endowed with the power of amœboid movement.

The fluid part of the vitreous body consists of water with a little albuminate of sc traces of mucin, and a small proportion of salts.

A blind canal, the *canalis hyaloideus*, or *canal of Stilling*, traverses the vitreous body fr the papilla optici to the back of the lens. It is a remnant of the canal which, in the fœt transmitted the branch of the *arteria centralis retinæ* to the *capsulo-pupillary membrane*. I about a line in diameter, but slightly widened behind, and is filled with a watery fluid. I best seen in the fresh eye. It may be injected by forcing a coloured solution under the matral sheath of the optic nerve.

The Hyaloid Membrane (Profs. Sharpey & Schäfer's Description).

The hyaloid membrane entirely invests the vitreous body, except in front, where it pas forward to the anterior part of the circumference of the lens, forming the *suspensory ligam of the lens*, or *zonula of Zinn*.

The posterior part of the hyaloid membrane, or hyaloid proper, is exceedingly thin a apparently structureless; but against its inner surface are generally found what appear to b few migrated white blood corpuscles capable of amœboid movement. This part of the me brane is adherent to the retina near the point of entrance of the optic nerve, at which poin few retinal vessels entered the hyaloid during fœtal life; elsewhere it may readily detached, when it usually becomes thrown into folds.

The more anterior part, that which forms the zonula of Zinn, is strengthened numerous radiating fibres apparently intermediate in character between the elastic & wh fibrous varieties (Schwalbe), which fibres commence opposite the ora serrata. This part furth presents small radiating folds, the *processus ciliares zonulæ*, which fit into the intervals of t ciliary processes of the choroid, and to which a little of the retinal pigment commonly remai attached.

Quite in front, *i.e.*, between the ciliary processes and the margin of the lens, the hyalo membrane again becomes smooth. It is here that it forms part of the posterior boundary the aqueous chamber, and also of the anterior boundary of the so-called canal of Petit. Th so-called canal of Petit is a zonular space triangular on section comprised between the hyalo membrane, the vitreous body, & the circumference of the lens. During life, it is believed to very limited in its extent, or even not to exist, the vitreous body normally reaching, or extendi very near to, the point of attachment of the hyaloid to the anterior lamella of the capsule the lens.

The Hyaloid Membrane (Different Views of Henle, Iwanoff & others).

The vitreous body is not, as has hitherto been generally admitted, surrounded by special membrane, the so-called *membrana hyaloidea*. This membrane is identical with t *membrana limitans interna* of the retina. It is a constituent part of the retina, and is applied the vitreous body only as far as the retina extends, that is as far as the ora serrata. From th point, the membrana limitans becomes continuous with the *pars ciliaris retinæ*, which latter separated from the vitreous body by meridianally running fibres. Henle, who demonstrated t non-existence of any distinct "hyaloid membrane," gave to the membrana limitans interna the retina the name of *membrana limitans hyaloidea*.

THE MEMBRANOUS LABYRINTH.

It is now known that the membranous semicircular canals and ampullæ do not *float* in the perilymph, as was believed up till lately, but that, on the contrary, they are flattened against, and attached to, the side of the osseous semicircular canals which corresponds to the convexity of their curve. Only that part of their circumference, which forms the concavity of their curve, is free, and bathed by the perilymph.

It has further been shown that the utricule & saccule communicate with each other by means of a small cœcal canal lined with epithelium, which lies in the aqueductus vestibuli: At its outer extremity this canal divides into two branches, which open, one into the utricule, the other into the saccule. As the saccule is continuous with the canalis cochleæ by means of the *canalis reuniens* of Hensen, the cavity for the endolymph is uninterrupted from one end of the membranous labyrinth to the other, as is also the cavity for the perilymph throughout the osseous labyrinth.

The walls of the semicircular canals, ampullæ, utricule, & saccule, are shown to consist, as was stated by Kölliker, of three layers, namely, an outer fibrous layer, a *tunica propria*, and a layer of epithelium.

The fibrous layer contains a few irregular pigment-cells. It is thinnest over the attached surface of the tube, where it blends with the periosteum, thicker over the free surface, and thickest at either extremity of the transverse section, *i.e.*, where the wall of the membranous canal leaves the osseous canal. And in these latter situations it is prolonged into numerous fibrous bands, which traverse the endolymph to become attached to the periosteum; many of these bands contain blood-vessels, and some of them reach the opposite side of the osseous semicircular canal, *i.e.*, the side of its concavity.

The tunica propria is a clear, glassy, homogeneous membrane, also thinnest over the attached surface, thicker over the free surface, and thickest at either extremity of the transverse section. Externally it is not always very clearly demarcated from the fibrous coat. Internally it is raised, except where it is thinnest, into numerous papilliform eminences, which project into the interior of the canals.

Where the ampullæ, and the utricule & saccule, are attached to the osseous wall, both this coat & the fibrous coat become somewhat modified; the fibrous coat forms a loose-meshed tissue traversed by the nerves, as explained below, and the tunica propria is considerably thickened. Hence result internal projections termed the *cristæ acusticæ*, or, in the ampullæ, the *septa transversa*.

In man, the epithelial layer consists of a single stratum of flattened cells, except over, and in the neighbourhood of, the *cristæ acusticæ*, where it undergoes the important modifications described below. In some of the lower mammalia it is considerably modified, however, in other situations.

Over the cristæ acusticæ there are three or four different kinds of epithelial structures: – Projecting from the surface, there are numerous long stiff cilium-like processes, the *auditory hairs*, which dip into the endolymph. Beneath these is a layer of large columnar cells of which the deep or attached extremity tapers to a point. Between the deeper ends of these columnar cells are some smaller spindle-shaped cells armed with elongated processes, which processes pass up towards the free surface between the columnar cells. In the deeper strata there are, according to Schultze, some elongated pyramidal cells, with broad attached bases, the upper tapering ends of which cells pass up between the structures already described, which structures it appears to be their office to support. Finally, there are, according to Retzius, several rows of nucleated bodies in the region of these pyramidal cells.

All these structures rest upon the loose-meshed tissue of the fibrous layer. The nerves traverse first this tissue and then the tunica propria. They lose their medullary sheath & dark contour either in the tunica propria (Schultze), or a little beyond it (Retzius), and they are then continued as simple axis-cylinders. These latter break up into a network of very fine fibrils.

Statements differ as to which of the superficial structures it is, that receive the terminal filaments of the auditory nerve, on the one hand, and, on the other hand, support the auditory hairs. According to Schultze, the filaments of the auditory nerve enter the deep ends of the spindle-shaped cells, and it is the superficial processes of these cells that support the auditory hairs; and further, according to Rüdinger, it is the nerve-fibrils themselves which, after traversing the spindle-shaped cells, and becoming connected with the nuclei, project beyond the free surface as auditory hairs. According to Retzius, on the contrary, it is the columnar cells which, on the one hand, receive the terminal filaments of the auditory nerve, and, on the other hand, support the auditory hairs.

It is not known what precise relation the otoliths bear to the other structures, or what their functions are.

THE MINUTE STRUCTURES of the COCHLEA.

Such are the uncertainties which still prevail with respect to the details of this subjec that, notwithstanding the most careful consideration, no basis for the tabulation thereof coul be found, which would not have been open to many objections. The subject is still *in embry* and should be gone into very thoroughly, or it will not be understood. In the Author's opinio the best advice to be given to those who wish to master it, is first to study carefully the admi able *résumé* given in the Eighth Edition of "Quain's Anatomy," and then to supplement this stud by that of Waldeyer's Article on the Auditory Nerve & Cochlea in Stricker's Handbook of Hi tology, the translation of which by Mr. Henry Power (for the New Sydenham Society), will b found in every public library. There is also a short but very good description in the Eight Edition of "Gray's Anatomy."

It would appear that the membrane of Corti, or membrana tectoria, ends in a thin fre edge above the outer set of hair-cells, or cells of Corti; the so-called *scala media* is therefore part of the *canalis cochleæ*.

Hence the spiral canal is divided into three parts only, the scala vestibuli above, the scal tympani below, & the canalis cochleæ in the middle. The scalæ vestibuli and tympani ar continuous with the cavity of the osseous labyrinth, and are filled with *perilymph*. The canali cochleæ is joined to the saccule by the canalis reuniens of Henle, and is filled with *endolymph*.

For a General View of the subject, see page 370.

SURGICAL ANATOMY.

THE TRIANGLES of the NECK.

The classical descriptions of the side of the neck, though a pretty faithful exposé of the parts seen as they lie on the dissecting-room table after a few hours of careful work with the scalpel, become inaccurate & useless when taken to represent the parts as they exist in the *undissected* body, and as they present themselves to the surgeon in the person of his patient: – To mention but one of the facts hitherto set aside by descriptive Anatomists, the sterno-mastoid is now known to cover the whole of the vasculo-nervous bundle of the neck, and even to extend forwards superiorly as far as, or very nearly as far as, the angle of the jaw, *as long as its sheath of deep cervical fascia remains intact.* – What becomes then of the anterior triangle?

This Tablet will therefore be found to contain little more than the mere boundaries of the triangles & sub-triangles as they are usually described, and a co-ordinate enumeration of the principal vessels, nerves, etc., which they have hitherto been said to contain. – The Author's description of the neck will appear among the Tablets on "Operative Anatomy."

ANTERIOR TRIANGLE

Is bounded by sterno-mastoid, middle line of neck, lower border of jaw & line from angle of jaw to mastoid process.

It is divided by anterior belly of omo-hyoid, and by stylo-hyoid & posterior belly of digastric into:

Inf. Carotid Triangle – Bounded by sterno-mastoid, anterior belly of omo-hyoid, & middle line of neck; contains beneath sterno-hyoid & -thyroid:

Common carotid artery, internal jugular vein, pneumogastric & sympathetic;
Inferior thyroid artery, recurrent laryngeal nerve;
Trachea, thyroid gland, lower part of larynx.

Sup. Carotid Triangle – Bounded by sterno-mastoid, anterior belly of omo-hyoid, stylo-hyoid & posterior belly of digastric; contains:

Termination of common carotid artery, internal & external carotid arteries, & first branches of the latter;
Superior thyroid, lingual, facial, & internal jugular veins;
Pneumogastric, superior laryngeal, & sympathetic nerves:
Hypoglossal & descendens noni nerves.
Upper part of larynx, lower part of pharynx.

Submaxillary Triangle – Bounded by median line, jaw-bone & line from angle of jaw to mastoid process, and by stylo-hyoid & posterior belly of digastric; contains:

Submaxillary gland, facial artery & vein;
Submental artery, mylo-hyoid artery & nerve;
Lower part of parotid gland, facial nerve, external carotid artery with its posterior auricular, temporal & internal maxillary branches;
Internal carotid, internal jugular vein, pneumogastric, sympathetic all separated from external carotid by stylo-glossus & -pharyngeus & glosso-pharyngeal n.

POSTERIOR TRIANGLE

Is bounded by sterno-mastoid, trapezius & clavicle.

Its floor is formed from above downwards by splenius capitis, levator anguli scapulæ, posterior & middle scaleni, and superior digitation of serratus magnus; – a part of the complexus is sometimes seen above the splenius.

It is divided by posterior belly of omo-hyoid into:

Sup. or Occipital Portion – The largest, contains:

Superficial cervical plexus & spinal accessory nerve,
Transversalis colli artery & vein,
Fat & lymphatic glands.

Inf. or Clavicular Portion – The smallest. Its size varies greatly with the extent of clavicular attachments of sterno-mastoid & trapezius, situation of omo-hyoid, and elevated or depressed position of shoulder. Contains:

Third part of subclavian artery,
Brachial plexus,
Transversalis humeri & transversalis colli vessels,
External jugular vein,
Fat & lymphatic glands.

PARTS CONCERNED in INGUINAL HERNIA — 1st T.

Form the inguinal & scrotal regions. From the latter are derived the superficial coverings of large herniæ, wh superficial coverings are the same as those of the cord & testis. The former comprises the parts m directly concerned in the occurence of the protrusion, and in the surgical operations thereby requi

SCROTAL REGION — Vide "Coverings of Cord & Testis."

INGUINAL REGION — Bounded by Poupart's ligament, median line, horizontal line through ante superior spine of ilium. Presents for examination the following strata, between which the ingui canal is compris

Skin - Thin, freely movable, depressed over Poupart's ligament.

Superficial Fascia - Continuous with that of thigh, scrotum (dartos) & perinæum. Divided into superfic & deep layers by the superficial vessels & nerv

SUPERFICIAL LAYER - Thick, areolar, & more or less distended with fat. Passes over Poupart's ligam without adhering to

DEEP LAYER - Thin, membranous, contains no fat; adheres to Poupart's ligament.

SUPERFICIAL VESSELS & NERVES — Are:

Arteries - Superficial epigastric, superficial circumflex iliac, superficial external pudic.

Veins - Corresponding; open into internal saphenous.

Lymphatics - Converge towards the

Superior or Abdominal set of Inguinal Lymphatic Glands - Three or four, sma obliquely disposed along Poupart's ligament; receive lymphatics of penis, scrotu perinæum, lower part of abdomen & buttoc

Nerves - Ilio-inguinal, & hypogastric branch of ilio-hypogastric.

Aponeurosis of External Oblique - Its fibres are oblique downwards & inwards, and form in successi *Poupart's ligament, Gimbernat's ligament, Outer or Inferior pillar of external abdominal ring, Inn or Superior pillar, Superficial part of Linea Alba* by decussating with their fellows, and perhaps als after decussating, the *Triangular ligament & the Intercolumnar fibres of opposite side* (Vide Abdomin Aponeuroses). Continuous with this stratum of fibres is the *Intercolumnar or external sperm tic fascia,* thin, closely adherent to margin of external abdominal ring, and prolonged downwar into a tubular process around cord and testi

Lower Part of Internal Oblique - Thin & pale. Its fibres, which arise from outer half of Poupart ligament, pass *inwards over spermatic cord (or round ligament),* and then curve *downwards behind* & behind external abdominal ring & Gimbernat's ligament, covering inner two-thirds of Hesselbach triangle and forming part of conjoined tendon of internal oblique & transversalis, and, becomin tendinous, are inserted over the extent of about half an inch into crest of pubes in front of rectus an into ilio-pectineal line behind Gimbernat's ligamen

THE CREMASTER MUSCLE - (Vide "Muscles of the Abdomen" & "Coverings of the Testicle is connected with lowest fibres of internal oblique, and occasionally also with some of the lowe fibres of transversali

Lower Part of Transversalis - Also thin & pale. Its fibres, which arise from outer third of Poupart ligament, take the same course as preceding, and, also becoming tendinous, are inserted with the into crest of pubes and ilio-pectineal line to the extent of about an inch, completing conjoined tendon

Fascia Transversalis - Part of the general layer of fascia which lines the abdominal & pelvic cavities. I the inguinal region it is thick and dense, and presents the following points of interest:

AT CIRCUMFERENCE OF INTERNAL ABDOMINAL RING - It is prolonged into a tubula process of membrane, the *infundibuliform fascia,* which descends round the cor & testis, forming the *fascia propria* round the latter

AT LOWER PART OF REGION - It is, -

In Front of Femoral Vessels - First thickened into an oblique band adherent to Poupart' ligament & termed the *deep crural arch,* and then continued downwards beneat Poupart's ligament in front of the vessels to form anterior wall of femoral sheath

Externally to Femoral Vessels - Attached to outer part of Poupart's ligament, and continuous with fascia iliaca

Internally to Femoral Vessels - Attached to crest of pubes & ilio-pectineal line behind conjoined tendon & Gimbernat's ligament.

That part of the fascia transversalis which lies above Poupart's ligament between outer border of rectus muscle & epigastric artery (Hesselbach's triangle) is interesting as being the part which forms a covering to direct inguinal hernia.

Subperitonial Areolar Tissue - More or less distended with fat. Forms a bed in which the epigastric artery passes upwards & inwards along lower & inner boundaries of internal abdominal ring; is continued into a loose sheath round the cord.

Peritoneum - Presents, before the superficial strata of the abdominal wall have been dissected, the two *Inguinal Fossæ, internal & external,* which fossæ correspond respectively to the external & internal abdominal rings, and are separated by an oblique crescentic fold of variable width & prominence, formed by the epigastric & obliterated hypogastric arteries.

PARTS CONCERNED in INGUINAL HERNIA – 2nd T.

INGUINAL OR SPERMATIC CANAL

Is an oblique passage 1½ or 2 inches long situated a little above, and parallel to, inner half of Poupart's ligament. It gives passage to the spermatic cord or round ligament, and presents for examination its two openings or rings, and its boundaries or walls.

External Abdominal Ring – Triangular & oblique downwards & inwards, about 1 inch long & ½ inch wide in male but rather smaller in female, bounded laterally by external & internal pillars, above by the intercolumnar fibres, below by the crest of the pubes. Gives off from its margin the intercolumnar or external spermatic fascia, which is prolonged into a tubular process around cord & testis (V. Abdominal Aponeuroses).

Internal Abdominal Ring – A tubular opening in the fascia transversalis formed by the prolongation of this fascia round the cord & testis (infundibuliform fascia, fascia propria), oval with large diameter directed downwards & outwards; situated midway between anterior superior spine of ilium & spine of pubes about ½ an inch above Poupart's ligament; bounded above & externally by the lower arched fibres of internal oblique & transversalis, below & internally by epigastric vessels.

Boundaries or Walls – Formed by:

In Front – Aponeurosis of *external oblique* along whole length; lowest fibres of *internal oblique* along outer third.

Behind – *Fascia transversalis* along whole length; *conjoined tendon* of internal oblique & transversalis, & also *triangular ligament* along inner third.

Above – *Arched fibres of internal oblique & transversalis.*

Below – *Poupart's ligament* blended posteriorly with fascia transversalis.

SURGICAL ANATOMY of INGUINAL HERNIA.

Principal points of interest are the coverings of the hernia, and the relations of the neck of the sac & of the seat of stricture. – For the rest see "Inguinal Hernia" among Tablets on Surgery.

COVERINGS — Differ in the oblique & direct forms, and are slightly modified also in the congenital & infantile varieties of the former, and in the external & internal varieties of the latter. They are as follows:—

OBLIQUE INGUINAL HERNIA

Of the Adult

FROM WITHIN OUTWARDS:

Peritoneum, subserous areolar tissue, infundibuliform fascia, cremasteric fascia, intercolumnar fascia, superficial fascia, skin.

FROM WITHOUT INWARDS:

Skin, superficial fascia, intercolumnar fascia, cremasteric fascia, infundibuliform fascia, subserous areolar tissue, peritoneum.

Congenital Variety – Descends directly into tunica vaginalis through pouch of peritoneum which accompanies cord & testis into scrotum, and which has abnormally remained *unclosed.* Its coverings are the same as those of testicle: – *Skin, dartos, intercolumnar fascia, cremasteric fascia, fascia propria, tunica vaginalis reflexa.*

Infantile Variety – Descends into the still patent upper part of the *imperfectly closed* pouch of peritoneum, and becomes more or less completely invested, especially in front, by the posterior part of the tunica vaginalis reflexa. Its coverings are *the same* as those of foregoing variety *with two additional layers of peritoneum*

DIRECT INGUINAL HERNIA

Internal or Common Variety – (Protrudes through inner part of Hesselbach's triangle, on inner side of obliterated hypogastric artery).

FROM WITHIN OUTWARDS:

Peritoneum, subserous areolar tissue, fascia transversalis (the general f. tr., not the infundibuliform process) *conjoined tendon* (*or not,* since it is frequently ruptured instead of being pushed forwards) *intercolumnar fascia, superficial fascia, skin.*

FROM WITHOUT INWARDS:

Skin, superficial fascia, intercolumnar fascia, conjoined tendon (*or not*), *fascia transversalis, subserous areolar tissue peritoneum.*

External Variety – (Protrudes through outer part of Hesselbach's triangle, on outer side of obliterated hypogastric artery, & externally to the conjoined tendon) – This exceptional form of inguinal hernia, passes through a considerable portion of the inguinal canal, and greatly resembles the oblique hernia both by presenting a certain degree of obliquity and by having very nearly the same coverings; the covering derived from the cremasteric fascia is alone rather less complete.

RELATIONS OF NECK OF SAC & SEAT OF STRICTURE — The neck of the sac lies

IN OBLIQUE INGUINAL HERNIA – *On outer side of epigastric artery and in front of spermatic cord,* the elements of which may, however, be more or less scattered round the neck of the sac.

IN DIRECT INGUINAL HERNIA – *On inner side of epigastric artery, in front & slightly on inner side of spermatic cord.*

On account of the uncertainty of the diagnosis between the oblique & direct herniæ it is an accepted rule in surgery to divide a deep seated stricture *directly upwards from middle of upper margin of constricting ring,* that is to say in the direction of the epigastric vessels.

THE ABDOMINAL APONEUROSES

Are the *anterior abdominal aponeurosis, or abdominal aponeurosis proper,* which is strengthened posteriorly by the fascia transversalis, and the *lumbar fascia.*

ANTERIOR ABDOMINAL APONEUROSIS — Is formed by aponeuroses of external & internal oblique, and by anterior aponeurosis of transversalis, which aponeuroses may be considered as expanded tendons of insertion. They all three assist in forming the linea alba & the sheath of the rectus.

APONEUROSIS OF EXTERNAL OBLIQUE — The strongest & widest of the three, and widest at its lower part; blended with aponeurosis of internal oblique in front of rectus and for some distance on either side, especially at upper part. Its fibres are oblique downwards & forwards, and form in succession *Poupart's ligament, Gimbernat's ligament, Outer or inferior pillar of external abdominal ring, Inner or Superior pillar, Superficial part of linea alba* by decussating with their fellows, and perhaps also after decussating, the *Triangular ligament & the Intercolumnar fibres of the opposite side.*

Poupart's Ligament - Strong curved band extending from anterior superior spine of ilium to spine of pubes, convex downwards & outwards, blended inferiorly with iliac fascia, internally with outer pillar of external abdominal ring, posteriorly with deep crural arch.

Gimbernat's Ligament - Small triangular process reflected downwards, outwards & backwards from inner part of Poupart's ligament to ilio-pectineal line, and of which the outer concave margin forms inner boundary of femoral ring.

Outer or Inferior Pillar of External Abdominal Ring - Blended with Poupart's ligament and attached with it to spine of pubes. Curves round inferior aspect of spermatic cord so as to form a groove upon which the cord rests.

Inner or Superior Pillar of External Abdominal Ring - Broad, thin; interlaces with its fellow in front of symphysis.

Linea Alba - Vide Below.

Triangular Ligament - A triangular band lying behind inner pillar of external abdominal ring & Gimbernat's ligament and in front of conjoined tendon, and extending from lower part of linea alba to ilio-pectineal line. It is formed according to some anatomists by prolongation across median line of lowest of those fibres of aponeurosis of external oblique of oppsite side which enter into formation of linea alba.

Intercolumnar Fibres - Are interwoven at right angles with, and bind together, the fibres of aponeurosis of external oblique, and more particularly those fibres which form the pillars of external abdominal ring. They extend downwards and outwards from middle & lower parts of linea alba to middle of Poupart's ligament describing curves convex inferiorly, and are said to be the continuation beyond the linea alba of middle fibres of aponeurosis of external oblique of opposite side. - Continuous with this layer of fibres is the *intercolumnar or external spermatic fascia,* thin closely adherent to margins of external abdominal ring, and prolonged downwards into a tubular process around cord & testis.

APONEUROSIS OF INTERNAL OBLIQUE — Thinner & rather narrower than foregoing, and narrowest at lower part. Divides opposite upper three-fourths of rectus into two layers, which blend, the one with aponeurosis of external oblique, the other with that of transversalis, and which pass, the one in front of, the other behind rectus, and again unite at linea alba. Passes wholly in front of lower part of rectus.

ANTERIOR APONEUROSIS OF TRANSVERSALIS — The narrowest of the three, especially above, where some muscular fibres extend a little behind rectus. Passes behind rectus in its upper three-fourths, blending with posterior layer of aponeurosis of internal oblique. Passes in front of rectus in its lower fourth, blending with aponeurosis of external & internal oblique.

SHEATH OF RECTUS — Is therefore complete in front and incomplete behind, where it corresponds only to upper three-fourths of the muscle; the deficiency in posterior wall of sheath being marked superiorly by the *Fold of Douglas,* a well defined fibrous band concave inferiorly. In front it is formed by all three aponeuroses below, but only by aponeurosis of external oblique & anterior layer of aponeurosis of internal oblique, above. Behind, it is formed, where it exists, by aponeurosis of transversalis & posterior layer of aponeurosis of internal oblique.

LINEA ALBA — Tendinous *raphé* from ensiform cartilage to pubes, bounded by inner borders of recti; narrow below & broad above; perforated by numerous vascular & nervous foramina, and by umbilicus, opposite which it is closely adherent to integument.

LINEÆ SEMILUNARES — Two curved depressed linear spaces produced on either side of recti, by absence of muscular fibres between these muscles and inner margin of muscular portion of internal oblique & transversalis.

POSTERIOR ABDOMINAL APONEUROSIS OR LUMBAR FASCIA — Formed by posterior aponeurosis of transversalis, the posterior layer of which aponeurosis is blended with vertebral aponeurosis and with aponeuroses of latissimus dorsi & serratus posticus inferior.

POSTERIOR OR VERTEBRAL APONEUROSIS OF TRANSVERSALIS — Divided into three layers.

Posterior or Superficial Layer - The strongest. Attached to *apices of spinous processes* of lumbar & sacral vertebræ, and blends with aponeuroses above mentioned. Gives origin to middle fibres of internal oblique, and binds down erector spinæ.

Middle Layer - Of considerable strength. Separates erector spinæ from quadratus lumborum, and becomes attached to *apices of transverse processes* of lumbar vertebræ.

Anterior Layer - The thinnest. Covers anterior aspect of quadratus lumborum, forming superiorly the ligamentum arcuatum externum, and becomes attached to *bases of transverse processes.*

SCARPA'S TRIANGLE — 1st Tablet.

Is a broad triangular depression

Situated at upper, inner, & front part of thigh;
Bounded by Poupart's ligament, sartorius & adductor longus;
Continued downwards & inwards into a superficial furrow, which **marks position of femoral artery in Hunter's canal.**

Its floor is formed from without inwards by iliacus, psoas, pectineus, & small part of adductor brevis.
It contains femoral vessels & anterior crural nerve, and the

PARTS CONCERNED IN FEMORAL HERNIA — These parts are :–

SKIN — Thin, freely movable, more or less studded with hairs at upper & inner part.

SUPERFICIAL FASCIA — Divided into two layers by superficial vessels & nerves & inguinal lymphatic glands.

SUPERFICIAL LAYER – Thick, areolar, contains a large amount of fat, and is continuous with subcutaneous tissue of surrounding regions; is rather thinner & less loaded with fat towards lower part of triangle.

DEEP LAYER – Thin & membranous. Adherent superiorly to Poupart's ligament. Stretches over saphenous opening under the name of "*cribriform fascia*," which fascia is perforated by internal saphenous vein & by numerous smaller blood & lymphatic vessels, and is attached firmly to outer margin of the opening, & slightly to the inner margin.

Superficial Vessels & Nerves and Lymphatic Glands – Are the :

Internal saphenous vein ;
Superficial epigastric, superficial circumflex iliac, superficial external pudic arteries with the corresponding veins, which latter open into internal saphenous near its termination;
Ilio-inguinal, crural branch of genito-crural, & external cutaneous nerves.
Lymphatic glands – Form two groups. Those of the

Superior or abdominal group – Are the smaller, and are placed transversely near Poupart's ligament; – they receive lymphatics of penis, scrotum, perinæum, lower part of abdomen & buttock; – those of the
Inferior or femoral group – Are the larger, and are vertically disposed round upper part of saphenous vein ; – they receive the lymphatics of lower limb.

DEEP FASCIA or FASCIA LATA — Dense, fibrous. Presents the saphenous opening, for easier description of which it is usually divided into two portions, the iliac & the pubic.

ILIAC PORTION – The thicker. Attached to crest of ilium, Poupart's ligament & spine of pubes. Is reflected downwards & outwards from this latter point, first bounding the superior angle, or *superior cornu* of the opening, then forming its outer margin. This outer margin is the *falciform process of Burns;* its upper part is often called *Hey's femoral ligament.* Superiorly this margin overlies the sheath of the femoral vessels. Inferiorly it becomes continuous with pubic portion of the fascia lata by a well defined curved border, which forms the inferior angle, or *inferior cornu* of the opening.

PUBIC PORTION – Much thinner. Is attached to pubic arch at upper and inner part of thigh, and is continuous with iliac portion opposite lower cornu of saphenous opening. From this point it is prolonged upwards & outwards behind femoral sheath & in front of pectineus, and becomes attached to ilio-pectineal line.

Saphenous Opening – Is formed therefore by the slitting of the fascia lata & by the folding of the two sides of the slit one over the other. It is oval in shape, broad below, narrow above, 1½ inches long, ½ an inch wide. Its

OUTER BOUNDARY & ITS SUPERIOR ANGLE OR CORNU, – Which are prominent & well defined, are formed by iliac portion of the fascia lata (falciform process & femoral ligament), which portion, as already stated, passes upwards & inwards in front of the femoral sheath, and becomes attached to Poupart's ligament & spine of pubes. – Its

INNER BOUNDARY – Depressed & less clearly defined, is formed by the pubic portion of the fascia lata, which portion, as already stated, passes upwards & outwards behind femoral sheath & in front of pectineus, and becomes attached to the ilio-pectineal line. – Its

INFERIOR ANGLE OR CORNU – Is formed by the junction of the iliac & pubic portions of the fascia lata just below opening of internal saphenous vein into the femoral.

FEMORAL SHEATH — Vide next Tablet.

SCARPA'S TRIANGLE — 2nd Tablet.

FEMORAL SHEATH — Is a thin tube of fascia divided by two delicate septa into three compartments, of which compartments the outermost contains the femoral artery & the crural branch of the genito-crural nerve, the middle one the femoral vein, and the innermost, which is called the femoral canal, some fat & a lymphatic gland.

It is expanded superiorly, where it is continuous beneath Poupart's ligament with the fasciæ of the abdomen, the fascia transversalis & the fascia iliaca passing down to form it, the former in front of, and the latter behind, the femoral vessels.

It is narrow inferiorly, and blends about two inches below Poupart's ligament with the common areolar sheath of the femoral vessels.

Anteriorly it is covered by the iliac portion of the fascia lata (falciform process & femoral ligament), Poupart's ligament, the deep crural arch, and, opposite the saphenous opening, by the cribriform fascia.

Posteriorly it rests upon the pubic portion of the fascia lata & the pectineus muscle.

Its outer wall is vertical, lies in immediate contact with the artery, and is perforated by the crural branch of the genito-crural nerve.

Its inner wall is oblique downwards & outwards from base of Gimbernat's ligament to inner surface of femoral vein. It is pierced superiorly, where it corresponds to the femoral canal, by numerous lymphatic vessels, and, inferiorly, or below the femoral canal, by the internal saphenous vein.

FEMORAL CANAL — Is the innermost compartment of the femoral sheath. Or rather it is the narrow interval comprised, at the upper part of the femoral sheath, between the inner wall of the sheath & the femoral vein; for it can hardly be said to exist as a distinct canal unless the wall of the sheath has been separated from the vein either by dissection or by the pressure of a hernia. – It contains a little fat & a lymphatic gland.

It extends from the femoral ring to the upper part of saphenous opening, and measures from ¼ to ½ an inch in length.

It presents four walls & two openings.

ANTERIOR WALL – Formed by the fascia transversalis, and supported by Poupart's ligament, deep crural arch, & iliac portion of fascia lata (falciform process & femoral ligament);

POSTERIOR WALL – Formed by the fascia iliaca; rests upon pubic portion of fascia lata & pectineus muscle;

INNER WALL – Formed by junction of fasciæ transversalis & iliaca;

OUTER WALL – Formed by the thin septum on inner side of femoral vein;

SUPERIOR OPENING, OR FEMORAL RING – Vide below.

INFERIOR, OR SAPHENOUS OPENING – Vide foregoing Tablet.

Femoral Ring – Is the opening of the femoral canal into the abdomen. – Its boundaries are:–

IN FRONT – Poupart's ligament and the deep crural arch;

BEHIND – Pubes covered by pectineus muscle, & pubic portion of fascia lata;

INTERNALLY – Gimbernat's ligament with the triangular ligament, the conjoined tendon, & the deep crural arch.

EXTERNALLY – Femoral vein & the thin septum between it & crural canal.

Its relations are as follows:

Femoral vein, on outer side;

Epigastric artery, crossing upper & outer angle;

Spermatic cord or round ligament, & pubic branch of epigastric above & in front;

Obturator artery, on inner side, in those rare cases in which the artery presents the double abnormality of arising from the epigastric artery, and of arising from that artery at some distance from its root; – the obturator artery then passes first inwards above the ring, and then downwards into the pelvis behind Gimbernat's ligament.

It is nearly circular, about ½ an inch wide in the male, a little wider in the female, and is closed by the

SEPTUM CRURALE (J. Cloquet) – A more or less condensed layer of superitoneal areolar tissue adherent to margins of femoral ring, and perforated by numerous apertures for lymphatics. Its upper surface is concave, and separated from the peritoneum by a less condensed layer of the same tissue and sometimes by a lymphatic gland; its under surface is convex & turned towards the femoral canal.

The femoral canal & both its openings are constricted by extension & eversion, and relaxed by flexion & inversion of the thigh.

COVERINGS OF FEMORAL HERNIA — Are:–

FROM WITHIN OUTWARDS: – *Peritoneum, subperitoneal areolar tissue* (a portion of which, thickened & caused to assume a membranous appearance by the pressure of the hernia, was described by Sir A. Cooper under the name of *fascia propria*), *septum crurale, crural sheath, cribriform fascia, superficial fascia, skin.*

FROM WITHIN OUTWARDS: – *Skin, superficial fascia, cribriform fascia, crural sheath, septum crurale, subperitoneal areolar tissue, peritoneum.*

The deep seated stricture is to be divided upwards & inwards, in which direction no important vessel is likely to be met with.

THE PERINÆUM

Consists of the structures which close outlet of pelvis anteriorly to line drawn from front part of one tuber ischii to that of the other.

It is triangular in form, and is bounded laterally by rami of pubes & ischia and posteriorly by above mentioned line. The width of its base (rather the smallest side of the triangle) is usually about 2¾ inches in the male adult, but it is sometimes considerably reduced; the operation of lateral lithotomy is then greatly impeded.

The part is convex in middle line & slightly depressed laterally, and presents the following layers:

Skin – Thin, dark, freely movable, marked by a prominent median *raphé*, studded with thin crisp hairs, and provided with numerous sebaceous follicles.

Superficial Fascia – Divided into two layers.

Superficial Layer – Thick, areolar, contains a large amount of fat, and is continuous with subcutaneous tissue of surrounding regions.

Deep Layer – Thin & aponeurotic; lies in close contact with the muscles.

On either side it is attached to rami of pubes & ischia externally to crura penis;

Behind it is connected to central tendinous point of perinæum; and is prolonged beneath sphincter ani, becoming continuous behind transversus perinæi & in front of rectum with inferior layer of deep perinæal fascia;

In front it is unattached, & continuous with dartos;

Superiorly it gives off a median septum, which is rather deficient in front but pretty well marked behind.

It binds down the superficial structures, and bounds inferiorly, and also, through its attachments, laterally & behind, a space, in which if urine be effused, this fluid will be directed forwards towards scrotum, perinæum, & lower part of abdomen, and prevented from passing backwards towards anus, or outwards towards thighs. This layer is sometimes called the *superficial perinæal fascia.*

Superficial Genito-Urinary Muscles – Are the:

Erector Penis – Covering the crus;

Accelerator Urinæ or Ejaculator Seminis – Spreading out upon bulb of urethra;

Transversus Perinæi – Separating perinæum proper from ischio-rectal region.

These muscles bound a triangular area, which is crossed superficially by the superficial perinæal vessels & nerve, behind which area passes transversely inwards the transverse perinæal artery, and through which area can be seen deeply the superficial layer of the deep perinæal fascia. In lateral lithotomy the knife is carried backwards & outwards through inner & back part of this area on left side.

Inferior Layer of Deep Perinæal Fascia, or Triangular Ligament of Urethra – Vide below.

Membranous Portion of Urethra, Compressor Urethræ, & Deep Transversus Perinæi, Pudic Vessels & N., Vessels & N. of Bulb, Cowper's Glands & their Ducts – Vide these parts.

Superior Layer of Deep Perinæal Fascia –

The deep perinæal fascia is a complex structure triangular in form, which supports the urethra, and closes anterior part of outlet of pelvis.

On either side it is attached to rami of pubes & ischia internally to crura penis;

Behind it is connected to central tendinous point of perinæum, and is continuous both with thin fascia on under surface of levator ani, and, behind transversus perinæi, with deep layer of superficial fascia of perinæum;

In front it is attached to pubic arch & sub-pubic ligament.

It consists of two aponeurotic layers which are separated in the centre, but united laterally & behind; of these two layers the

Anterior, Inferior, or Superficial Layer – The thickest, is continued downwards & forwards upon anterior part of membranous portion of urethra, and is lost upon the bulb. This layer is perforated by the *urethra* about an inch below symphysis pubis, by *dorsal vein of penis* in front of urethra, & by *pudic vessels & nerve* on either side of the vein; it is the only layer that can properly be called the triangular ligament of the urethra, though the term is sometimes applied to both layers taken together.

Posterior, Superior, or Deep Layer – Thinner. Is continued upwards & backwards round posterior part of membranous portion of urethra, and becomes continuous with pelvic fascia.

Between these two layers are comprised the parts above mentioned, viz,, *membranous portion of urethra* with *compressor urethræ & deep transversus perinæi muscles, pudic vessels & nerve* with *vessels & nerve of bulb, Cowper's glands & their ducts.*

Above these parts are found in centre of perinæum the

Prostate Gland & Neck of Bladder, – and laterally the

Anterior Part of Levator Ani & of Pelvic Fascia – The latter fascia is continued posteriorly upon posterior part of levator ani, upon rectum & between it & bladder, and belongs as much to ischio-rectal region as to the perinæal.

THE MUSCLES of the MALE PERINÆUM.

ANAL GROUP.

Sphincter Ani – Tip & back of coccyx and superficial fascia in front of it.

Central tendinous point of perinæum blending with accelerator urinæ, transversus perinæi & levator ani. – S. by inferior hæmorrhoidal branch of pudic, & by anterior division of 4th sacral nerve.

Levator Ani – Back of pubes close to symphysis, spine of ischium, and, between these two points, from a white band or thickening of the pelvic fascia which marks point of division of the latter fascia into obturator & recto-vesical layers.

Side & apex of coccyx, median raphé between coccyx and anus, side of lower part of rectum blending with sphincter ani, and decussates with its fellow in front of rectum and below & behind the prostate forming the so-called levator prostatæ, which latter fasciculus is sometimes separated from the remainder of the muscle by a little areolar tissue. – S. by anterior division of 4th sacral n.

Coccygeus – Spine of ischium & lesser sacro-sciatic ligament.

Side of coccyx and of lower piece of the sacrum. – S. by anterior divisions of 4th & 5th sacral nerves.

Internal Sphincter – Is a thickened circular band of the unstriped muscular fibres of the intestine.

GENITO-URINARY GROUP.

Accelerator Urinæ, Ejaculator Seminis, or Bulbo-cavernous – Central tendinous point of perinæum & median raphé in front of it.

Its posterior fibres are inserted into the triangular ligament; its middle fibres decussate above the bulb & corpus spongiosum which they encircle; its anterior fibres are partly inserted into the corpus cavernosum, and partly joined above it in a tendinous expansion which covers dorsal vessels & nerves of penis. – S. by superficial perinæal nerve.

Erector Penis, or Ischio-cavernous – Inner aspect of tuberosity of ischium behind crus penis and pubic arch on either side, back part of under surface of the crus.

By a tendinous expansion into fore part of under & outer surfaces of crus penis. – S. by superficial perinæal nerve.

Transversus Perinæi – Inner & fore part of tuberosity of ischium.

Central tendinous point of perinæum blending with its fellow, the accelerator urinæ, & sphincter ani. – S. by superficial perinæal nerve.

Compressor, or Constrictor Urethræ – Upper part of pubic arch on either side of symphysis.

Its fibres surround membranous portion of the urethra, decussating above & below it. – S. by pudic nerve.

Deep Transversus Perinæi – Is a thin fasciculus which may or may not be separated from posterior fibres of foregoing muscle. It decussates with its fellow behind the bulb, and covers Cowper's gland.

THE PELVIC FASCIA

Is continuous with fascia over psoas & iliacus and with fascia transversalis, and is slightly adherent to brim of pelvis, especially at sides.

It is thin posteriorly, where it covers pyriformis muscle & sacral plexus, and passes behind internal iliac vessels which perforate it.

In front it forms a single thick layer over obturator internus as low down as a white linear thickening, which linear thickening extends in a curved direction from spine of ischium to side of lower part of symphysis pubis, and both gives attachment to middle fibres of levator ani, and marks point of division of pelvic fascia into recto-vesical & obturator layers, or recto-vesical & obturator fasciæ.

Recto-Vesical Fascia -

Is continued over inner surface of levator ani to bladder, prostate or vagina, & rectum.

In front it forms anterior true ligaments of bladder, or pubo-prostatic ligaments.

Further back it ascends over side of prostate, inclosing this gland & the prostatic plexus of veins, and is then continued on the bladder forming its lateral true ligaments.

Posteriorly it sends a prolongation between the bladder & rectum, which prolongation invests the vesiculæ seminales.

Obturator Fascia -

Descends on portion of obturator internus muscle which lies beneath levator ani, and becomes attached to pubic arch & sacro-sciatic ligaments.

It forms a canal for pudic vessels & nerve, and gives off a thin layer, the anal or ischio-rectal fascia, to under surface of levator ani & to third part of rectum.

THE SIDE VIEW of the MALE PELVIS.

How to obtain it (the Perinæum having been previously dissected): –

Incline bladder & rectum to the right.
Divide on left side obliterated hypogastric, vesical & middle hæmorrhoidal arteries, (and the uterine & vaginal in female), lateral true ligament of bladder & levator ani muscle.
Saw through pubes externally to left anterior true ligament of bladder.
Divide right common iliac artery & left common iliac vein, and saw through sacrum & coccyx just to the left of middle line.
Detach deep perinæal fascia & the contained compressor urethræ muscle from rami of pubes & ischium.
Introduce catheter into, and inflate, bladder; distend rectum with tow.

What it shows: –

Towards middle: –

Cut edge of the deep perinæal fascia, containing between its two layers: –
- *Cut edges of compressor urethræ & deep transverse muscles;*
- *Membranous portion of urethra;*
- *Pudic vessels & nerve with the vessels & nerve of the bulb;*
- *Cowper's glands & their ducts.*

Below and in front of the deep perinæal fascia: –

Bulb of urethra partly covered by prolongation of anterior or inferior layer of deep perinæal fascia, which latter passes down upon it and becomes lost on its surface.

Above and behind the deep perinæal fascia: –

Cut edges of levator ani muscle & of recto-vesical layer of pelvic fascia, which latter is seen further up to ascend upon bladder, prostate, & rectum.

The viscera of the pelvis and the vessels & nerves of the right side can now be examined conveniently.

PARTS CONCERNED in LATERAL LITHOTOMY

Parts to be divided: –

1. *Integument, superficial fascia, inferior hæmorrhoidal vessels & nerve;*
2. *Posterior fibres of accelerator urinæ & transversus perinæi muscles; probably also the transverse perinæal artery and superficial perinæal vessels & nerves.*
3. *Deep perinæal fascia, left deep transversus perinæi muscle & posterior fibres of compressor urethræ; the anterior fibres of levator ani;*
4. *Membranous & prostatic portions of urethra, and part of prostate gland.*

Parts to be avoided: –

1. *The bulb and its artery* are endangered if incision is begun too far forwards; – if the artery arises further back than usual it is exposed to be divided whatever care be taken;
2. *The rectum* is endangered if incision is begun too far inwards;
3. *The pudic artery*, if incision is carried too far outwards;
4. *Entire breadth of prostate with prostatic veins & accessory pudic artery, if the latter exist*, may be divided if incision into the deep parts is carried too far backwards, and the urine may then become infiltrated between the bladder & rectum.

THE ISCHIO-RECTAL REGION.

Corresponds to the portion of outlet of pelvis situated behind a line drawn from front part of one tuber ischii to that of the other. It is bounded in front by above mentioned line; its apex is at point of coccyx; its sides are formed by tuberosities of ischium, great sacro-sciatic ligaments & great glutei muscles.

It contains terminal portion of rectum surrounded by levatores ani and the internal & external sphincters, and on each side of which is the ischio-rectal fossa.

It is triangular in form and depressed centrally towards anus, round which aperture the integument is thrown into numerous folds, and becomes continuous with mucous membrane of intestine.

The skin is dark, but thicker & less movable than on perinæum proper, and contains a few hair-follicles.

The subcutaneous areolar tissue or superficial fascia hardly exists in centre of region, or over sphincter ani, which muscle is closely adherent to integument; but it is abundant laterally, where it is loaded with a large amount of fat, and where it dips into and fills the ischio-rectal fossa.

ISCHIO-RECTAL FOSSA

Is a large excavation which sinks deeply into pelvis on either side of rectum, and which is filled with a considerable amount of loose fatty areolar tissue.

It is wide & triangular at its

Base, – Which corresponds to integument, but it is flattened from side to side and diminished in size superiorly. – Its

Inner Wall – Is oblique downwards & inwards and formed by under surface of levator ani & by sphincter, which muscles are covered by anal fascia.

Outer Wall – Is vertical, and is formed by obturator internus covered by obturator fascia; it presents the pudic vessels & nerve enclosed in a sheath of fascia.

It is bounded:

Above – By junction of anal & obturator fasciæ.

In Front – By junction of the same fasciæ superiorly, and, inferiorly, by junction of the superficial & deep perinæal fasciæ behind transversus perinæi.

Behind – By sacro-sciatic ligaments, coccygeus & the gluteus maximus.

The vessels & nerves it contains are the:
Inferior hæmorrhoidal, in the centre;
Pudic, in the outer wall;
Superficial perinæal, in front;
A branch of 4th sacral nerve, and branches of sciatic artery & small sciatic nerve, behind; the branches of the latter nerve winding round lower border of gluteus maximus.

Above levator ani is the recto-vesical layer of the pelvic fascia (Vide Pelvic F.)

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